OCTOBER 3, 1958

electronics

business issue

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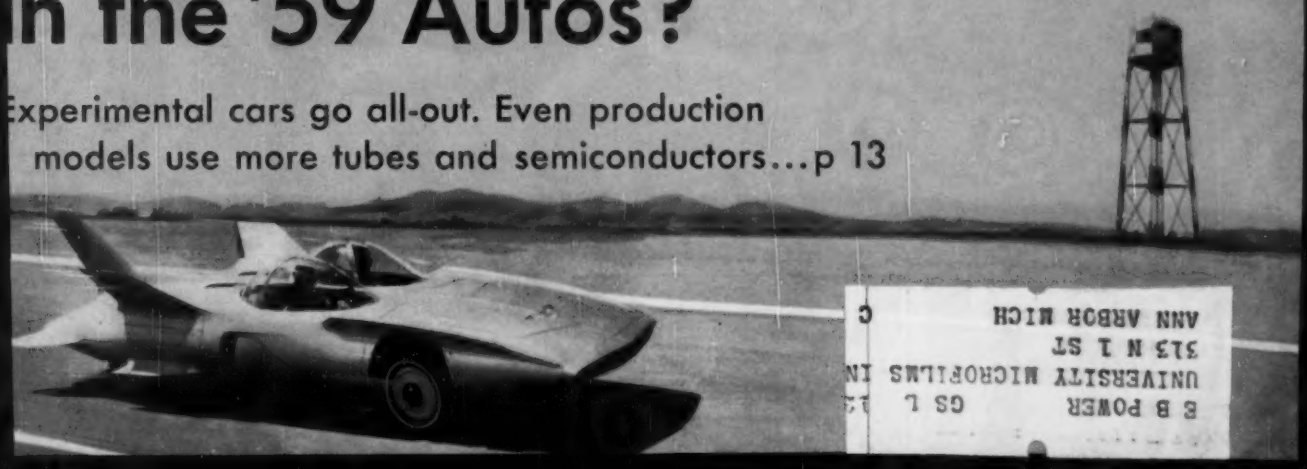
College Research Vital to Defense

ervices spend $100 million a year for data and gear like Jupiter's instrument panel... p 15

What's Electronic in the '59 Autos?

Experimental cars go all-out. Even production models use more tubes and semiconductors... p 13



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Shoptalk . . .

MORE ELECTRONICS IN AUTOS? Experimental automobiles such as the GM Firebird (cover) have shown that many jobs now being done mechanically can be done electronically.

> **Now, as the '59 model cars start coming off assembly lines this Fall, members of our industry are asking which of these developments will result in more electronic components in the family car.**

Associate Editors Bushor and Emma have just completed a searching study of the automobile industry. Emma's story "Electronics in Tomorrow's Cars" begins on p 13. Bushor's comprehensive technical report will follow in one of our Engineering Issues.

BRAINPOWER. Coping with the challenges of missiles, satellites and space rockets requires combined efforts of the country's best technical minds. Department of Defense contracting with colleges and universities continues to enrich the military's stockpile of new discoveries.

> **A few examples: instrument panel in Army's Jupiter and ground-based instrumentation to be used at Cape Canaveral are built in Pennsylvania State University's labs; instrumentation for the Explorer satellites and for high altitude rockets is built at Iowa State.**

A close look at some of this research program is provided in Associate Editor Mason's article on p 15.

ANTI-ICBM. When Soviet long-range missile advances became known early this year and our whole military defense effort was shaken up, an antimissile missile seemed to many to be the Number One goal of military technology.

> **The Army's Nike-Zeus appeared early to be the primary project aimed at reaching that goal. Along the way several things have happened: (1) Advanced Research Projects Agency was formed and given responsibility in the antimissile missile area; (2) the administration has cautiously tended to spend less on defense than the limits voted by Congress.**

Although the state of the antimissile art is still heavily veiled by security, some significant progress has been reported. On p 17, Associate Editor Janis brings you up to date on where our anti-ICBM program stands today.

TO MARKET, TO MARKET. Business of moving electronic products has kept pace with the growth of our industry and seen many changes.

> **Talks with transport men reveal an active seeking-out of electronics business. Firms whose sole concern at one time was moving household goods now promote their services for moving delicate computers and components. Airlines traffic managers say electronics is now high on their list.**

The facts and figures of how the growth of our industry has affected the men who route the truck, trains, and planes are included in Associate Editor Emma's article on p 18.

Coming In Our October 10 Issue . . .

Coming in Our October 10 Issue . . .

● **Moon Over Massachusetts.** The International Geophysical Year is drawing to a close, but the exotic investigations of outer space with instrumented satellites will continue for a long time to come.

One method of locating and tracking the Explorer and Vanguard satellites with a specially designed interferometer system is described in our cover story by radiation engineers Sletten, Forbes and Shodin of the AF Cambridge Research Center, Bedford, Mass. They designed and built a dual-terminal linear array of dipoles proximity-coupled to a two-wire transmission line.

In conjunction with a companion receiver, meridian transit times and satellite angle bearings have been accurately determined despite low signal levels.

● **Undersea Telemeter.** Naval underwater ordnance must be monitored during development stages by reliable data-gathering techniques, according to the U. S. Naval Ordnance Lab's M. J. Aucremanne and D. D. Woolston.

Their article describes a system whereby the performance of four weapons such as mines can be monitored simultaneously. Transistorized transmitters convert the data to acoustic signals which are relayed to a shore-based receiver by cable after detection by a hydrophone.

● **Cement Setting Time.** An interesting technique for determining the setting time for cement mixtures is outlined by J. M. Tobio, an engineer at the Instituto Tecnico De La Construccion Y Del Cemento in Madrid.

The measurement consists of successive determinations of variations in admittance of a cement paste during the setting process. The mixture is placed in a capacitor consisting of two coaxial rings encircling a test tube. Admittance measurements are made every 15 minutes; maximum admittance signifies end of setting process.

● **Spectrum Stretching.** Modern military communications is complex, and usable spectrum space is at a premium. Decreasing the interchannel spacing from 100 to 50 kc doubles the number of available channels, but introduces ticklish problems in frequency control.

Communications equipment designers Brauer and Kammer of Avco Manufacturing Corp. describe a new transceiver system which furnishes 920 channels in the range of 30 to 76 mc. The transceiver has 10 present channels manually or servo-tuned. This equipment is the first transistorized vehicular system designed completely for 50-kc channel spacing.

● **Plate Memory.** Magnetic core memory elements are costly and handwiring techniques for assembling core matrixes boost prices for digital computer memories.

According to RCA computer engineers Newhouse, Kornfield and Kaufman, a ferrite plate memory with a matrix formed by drilled holes can considerably reduce cost. Such a memory with the attendant switching circuits in an end-fired configuration is described in their article next week.

electronics business issue

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College Market Grows. Increased research work by educational institutions creates sales. Replacing of permanent test and experimental gear goes on. New devices are continually being purchased as prototype work mounts .....p 15

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electronics

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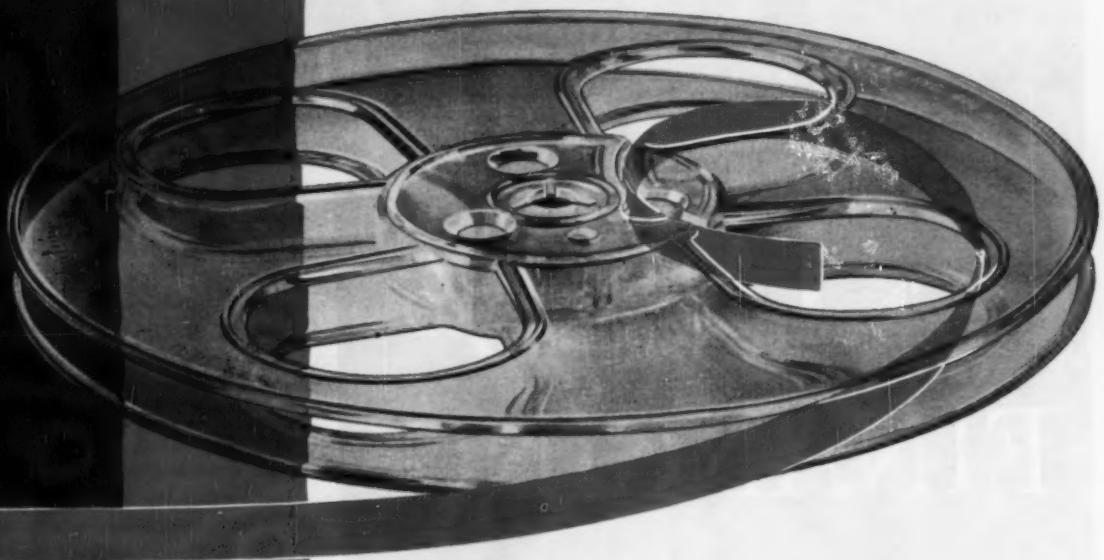

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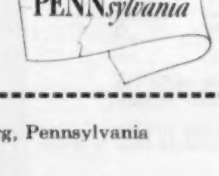

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FINANCIAL ROUNDUP

Future Financing

Record-high stock market prices and rising sales point to issuing stock now, some brokers say

ISSUE STOCK NOW? It's a question that faces many electronics firms today.

Surface indications strongly point to a yes answer. Average stock market prices recently rose from a two-year low to an all-time high.

Moreover, rising industry sales volume points to need for more capital to finance higher receivables, new plant and equipment. To top it off, interim financing through bank loans is getting more expensive; big banks boosted prime borrower's rate from 3½ to 4 percent last month.

But investment bankers report no significant increase in number of planned new electronics issues. Also, conversations with industry executives show that many have looked at today's new issue market, but for one reason or another have decided not to take advantage of the apparent opportunity. Unsettled market conditions and fear of a price break have led some firms to make other financing arrangements.

Though average stock market prices are high, arranging a satisfactory price at which an issue can be sold is often a stumbling block in negotiating electronics deals, some investment bankers report. Fact that small blocks of stock are currently being traded at high prices does not prove that large blocks can be sold at the same price, they say.

Bankers also report that investment interest is now centered in firms which have both good prospects and a good record of past earnings. Speculative money, once freely available for firms with little more than future prospects to offer, is drying up fast, they say.

But other investment bankers feel that the picture of unsettled market conditions and pricing problems has been painted too darkly.

Electronics stocks are a Wall Street style favorite today, a financial authority says, and industry firms would do well to take advantage of their special situation while they may. He also believes that many firms, which are delaying stock issues until they feel the full financial impact of the business pickup, may be making a mistake.

Most dealers specializing in small, first-time issues say if the price is realistic there is a good market.

A favorable development among small issue dealers is that several have decided to discontinue underwriting electronics stocks on a best effort basis and to make firm commitments.

Also, there are avenues for avoiding some of today's market pitfalls.

Direct or private placement (sale of a security issue to a few large investors like investment trusts, pension funds and big individual investors) bypasses the risk of a market break in future months. For instance, Perkin-Elmer, which directly placed 25,000 shares of common stock last month, was able to complete its arrangements in a few hours.

For those who have been having difficulty in selling common stock at the right price, convertible debentures may be the answer. Such debentures are bonds which give holders rights to convert into common stock and share in growth prospects.

Declining prices of most regular or nonconvertible bonds, largely influenced by inflation fears, have given convertible prices a strong lift, convertible debenture specialists say.

Debentures of a first-class electronics firm can be sold today with a stock conversion price pegged at a point about 15 percent above the present market price of the stock. However, one disadvantage to be considered is that the interest payment on new convertibles is rising along with the general hike in interest rates.

SHARES and PRICES

FIVE FIRMS listed below recently announced new security issue plans and are preparing for sale under present conditions described in story above. New issues include common stock, convertible debenture and preferred issues.

Name and Address	Security	Price	Underwriter
General Devices, Princeton, N. J.	40,000 shs com	$3.50 per sh	None
Haydu Electronic, Plainfield, N. J.	$300,000 of 6% conv debs	Par	Berry & Co.
Int'l Rectifier, El Segundo, Calif.	180,000 shs com[1]	———	Blyth & Co.
Milgo Electronic, Miami, Calif.	10,000 shs com	$24–$26[2]	None
Precise Development, Oceanside, N. J.	60,000 shs com 60,000 shs conv pfd	$5 per two shs, one each class	R. A. Holman & Co.

[1] 80,000 shs for company and 100,000 shs for selling stockholders
[2] $24 to stockholders and $26 to public

MERGERS, ACQUISITIONS and FINANCE

• **Office of Civil and Defense Mobilization** issues permits to three electronics firms for fast depreciation write-offs of more than $3 million of research and production facilities. The permits allow firms to depreciate the properties in five years instead of the normal life span of about 20 years. Result, income taxes are lowered in early years of facility life and raised in later years. **Western Electric** was allowed fast depreciation on 50 percent of $1,335,000 expansion of its research facility for electronic systems at Whippany, N. J. **General Dynamics** was granted rapid depreciation authority for 60 percent of $446,220 expansion cost of a missile test facility in San Diego, Calif., and for 65 percent of the $393,273 cost of expanding military airplane production and research facilities at Fort Worth, Texas. **Hughes Aircraft** was allowed faster-than-normal depreciation on 65 percent of the $990,780 cost of an electronics systems research lab at Culver City, Calif.

• **Perkin-Elmer** of Norwalk, Conn., privately places 25,000 shares of common stock at $31 a share through Blyth & Co. Last November the firm sold 75,000 shares of its common stock through public issue at $20 a share, $11 less than the recent private placement price.

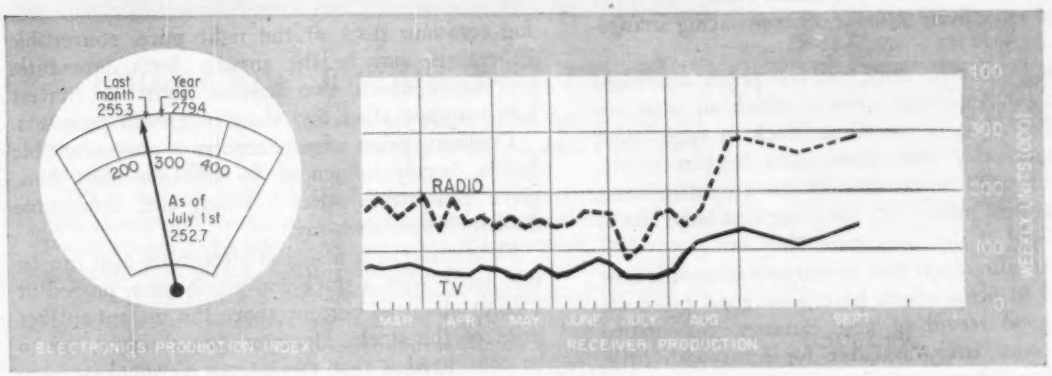
Proceeds from sale of the 25,000 shares will be added to working capital and will provide potential for new avenues of corporate development.

• **Garrett Corp.**, L. A. manufacturer of electrical-electronic equipment for aircraft and missiles, successfully completes public sale of $10 million worth of 4⅞ percent convertible subordinated debentures. The debentures can be converted to common stock at rate of one share for every $46 of debenture value. Common was recently traded at 40⅜, about 14 percent below the conversion price.

• **Divco-Wayne Corp.** acquires **Gruen Watch Co.'s Electronics Division,** located in Cincinnati, Ohio. D-W produces school busses, funeral cars, ambulances and delivery trucks at plants located in Richmond, Ind., and Piqua and Bellefontaine, Ohio. Purchase was for cash but amount was not disclosed. D-W management anticipates its financial resources will spur future development of the former Gruen division.

Gruen sold out in order to concentrate all its activities on the watch business.

• **Universal Products Co., Inc.,** Wilmington, Del., changes its corporate name to Universal Controls, Inc. **American Totalisator,** racetrack equipment subsidiary of Universal, has merged with the parent company and became a division. The merger is expected to result in substantial tax savings. New name will be more descriptive of the company's automation, electronic and business control devices, Universal management says.



FIGURES OF THE WEEK

RECEIVER PRODUCTION

(Source: EIA)	Sept. 12, '58	Sept. 5, '58	Sept. 13, '57
Television sets, total	145,289	112,992	161,749
Radio sets, total	295,249	274,604	327,829
Auto sets	89,210	91,738	91,068

STOCK PRICE AVERAGES

(Source: Standard & Poor's)	Sept. 17, '58	Sept. 10, '58	Sept. 18, '57
Radio-tv & electronics	59.10	56.64	47.97
Radio broadcasters	69.22	68.71	59.16

FIGURES OF THE YEAR

	1958	Totals for first seven months 1957	Percent Change
Receiving tube sales	221,201,000	254,252,000	—13.0
Transistor sales	21,084,218	12,902,300	+63.4
Cathode-ray tube sales	4,239,404	5,306,594	—20.1
Television set production	2,442,929	3,082,799	—20.8
Radio set production	5,582,834	7,799,882	—28.4

LATEST MONTHLY FIGURES

EMPLOYMENT AND EARNINGS

(Source: Bur. Labor Statistics)	July, '58	June, '58	July, '57
Prod. workers, comm. equip.	339,400	339,700	395,600
Av. wkly. earnings, comm.	$81.35	$82.39	$75.85
Av. wkly. earnings, radio	$80.99	$81.60	$75.05
Av. wkly. hours, comm.	39.3	39.8	39.1
Av. wkly. hours, radio	39.7	40.0	39.5

TRANSISTOR SALES

(Source: EIA)	July, '58	June, '58	July, '57
Unit sales	2,631,894	3,558,094	1,703,000
Value	$6,598,762	$8,232,343	$4,216,000

TUBE SALES

(Source: EIA)	July, '58	June, '58	July, '57
Receiving tubes, units	30,795,000	36,270,000	33,077,000
Receiving tubes, value	$26,927,000	$31,445,000	$27,042,000
Picture tubes, units	549,817	725,846	491,935
Picture tubes, value	$11,109,048	$14,203,381	$9,835,586

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Before your designs for electronic equipment get too far along, be sure to provide for dependable cooling. Specify an American Blower packaged air-moving unit. Numerous sizes and designs to choose from — many can be modified as needed. Or, if necessary, we can start from scratch and design a fan or blower to fit your exact needs. Individual specification bulletins are available; write, detailing your requirements. American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

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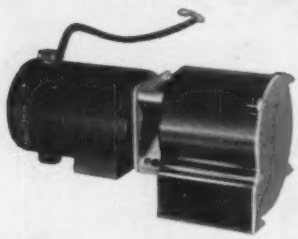
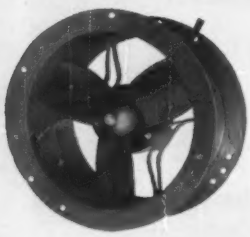


Designed for military applications. Capacity: 35 cfm @ 4" sp to 80 cfm @ 1.5" sp @ 8000 rpm approx. Write for Bulletin 312.

FOR AIR-FLUSHING CABINETS AND RACKS



Tubeaxial fan, double-flanged for mounting at either end. Capacity: 295 cfm, free delivery @ 1550 rpm. Bulletin 5112.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

American-Standard
AMERICAN BLOWER DIVISION

CIRCLE 4 READERS SERVICE CARD

WASHINGTON OUTLOOK

A $150-MILLION world-wide communications network to be built by ITT will cut from hours to minutes the time it takes to give Strategic Air Command headquarters in Omaha, Nebr., a complete picture of the disposition of its aircraft. The new system will tie together the 40 U.S. bases and 10 overseas at which SAC keeps bombers on a 24-hour alert.

Reports coming in from each SAC base through the new communications net will be fed into a computer that, in seconds, will give the SAC commander his maximum retaliatory capability to any target in the world. It now takes hours to produce the same information.

Fifteen companies made bids to the Air Force for the project. System will comprise communications, data processing and data presentation subsystems. Further details await selection of subcontractors.

● **Patent law revision** will be proposed again in the 86th Congress.

This year, Sen. O'Mahoney's Senate Subcommittee on Patents, Trademarks and Copyrights confined its activities to sponsorship of scholarly critiques on the present patent system. Critiques were written by outside experts.

The effort to overhaul and increase patent fees will be made again. This year the proposal failed to get out of the House Judiciary Committee.

Congress did raise Patent Office salaries, aimed at keeping key personnel. Probably all of O'Mahoney's pet proposals will be reintroduced in the next Congress. Among others, his ideas include such things as:

Creation of a single Court of Patent Appeals.

The so-called "20-year bill", aimed at eliminating stalling tactics of some applicants by limiting the life of a patent to a maximum of 20 years from date of application or 17 years from date a patent issues—whichever is shorter.

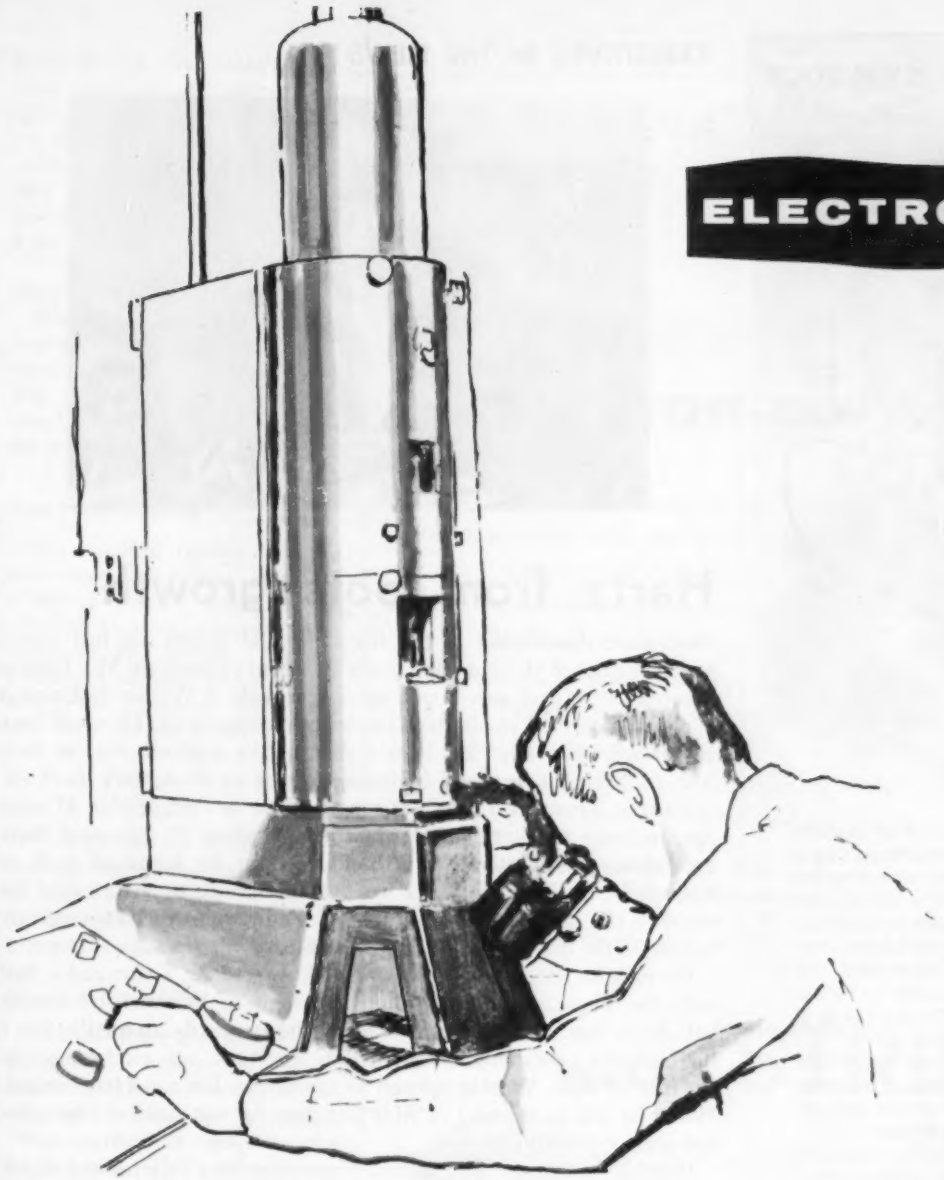
A publication bill, aimed at cutting down on "defensive patenting". O'Mahoney would allow an inventor to have the patent office publish his application for a patent, thereby establishing his priority to an invention.

● **Government officials** are keeping a sharp eye on two economic indicators that are important to electronics manufacturers. Both are surface signs hinting there are solid economic undercurrents beginning to take hold and push business upward.

For one thing, businessmen have told the government's economic pollsters that they are raising their sights on plant and equipment spending. Modernization and process controls are prominently involved. Suppliers of new equipment—the kind that lowers unit costs—should reap the benefit.

The other factor is an already reported steep increase in productivity and business profits.

There's another side to the picture, though: unemployment and inflation. Government experts expect the upward pressure on prices to continue, and don't see much reason to expect unemployment to decline.



ELECTRONICS

SAN ANTONIO . . . IDEAL FOR ELECTRONICS

Labor Resources . . .

- Over 3000 now employed in electronics.
- Over 2000 now employed in research and development.
- Ready pool of trainable labor.
- Manufacturing employees wage rates 25% lower than national average. (Bureau of Labor statistics.)
- Work stoppage virtually unknown.

Living Conditions . . .

- Average mean temperature 50.6 degrees winter, 84.4 summer.
- Outdoor living year round.
- 2500 acres of parks.
- Hunting, fishing, motor boating, water skiing.
- 3 hours to gulf coast and Old Mexico.
- Old world atmosphere features the Alamo, 4 other Missions, La Villita and many other historic sites.

In addition to excelling in labor resources and living conditions, San Antonio offers all the other locational factors — good government, banks that support industry, abundant electricity, natural gas and water, excellent sites, good transportation and distribution facilities, equitable taxes, plenty of room for industrial expansion.

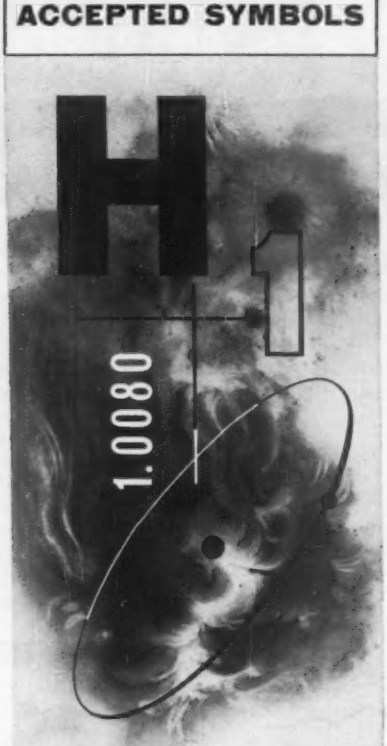
City in the Sun

SAN ANTONIO

For a detailed study of your specific needs
Write Greater San Antonio Development Committee
153 Navarro, P. O. Box 1628, San Antonio, Texas
All communications confidential

CIRCLE 5 READERS SERVICE CARD

ACCEPTED SYMBOLS



Hydrogen! Lightest of all elements . . . part of all living things! Cog in the nation's weapon-missile program!

Hydrogen fills Tung-Sol/Chatham thyratron tubes used in tracking beacons and radar modulators—two means of missile observation. The tubes provide the power for the signals or "beeps" that describe to us missile flight behavior.

Miniature types pulse "beeps" from airborne missiles. "Beeps" pulsed by giant thyratrons in ground units, resound from missiles in flight.

Hydrogen thyratrons — exclusive Tung-Sol/Chatham development — supply the premium quality performance critically needed in missile experiments. Over the years, Tung-Sol consistently has woven a thread of similar quality throughout its products. So, today, the Tung-Sol mark remains a symbol of the finest.

Tung-Sol Electric Inc., Newark 4, N. J.

TUNG-SOL

Quality Electronic and Automotive Components

CIRCLE 6 READERS SERVICE CARD

Hartz: from roots, growth

CONFIDENCE and belief in the free enterprise system are two salient characteristics of William Hartz, new president of newborn Mid-Eastern Electronics. It took guts to pull up 22-year roots at Weston Instrument and start a business in ultrahigh-resistance measurement. His confidence is justified now: after less than a year, and a recession year at that, M-E is "paying its way and beginning to pick up its debts."

Hartz is a man who sinks deep roots. Born in Philadelphia 47 years ago, he came to North Jersey when he was about 10, has lived there ever since. Mid-Eastern's new building is in an industrial park in Springfield, N. J., where Hartz has lived ever since two years after his marriage (he and Mrs. H., a warm and friendly woman who is currently helping in the business, celebrate their 20th anniversary week after next).

He took his B.S.E.E. at MIT in 1934, worked for a year and a half with the Thomas A. Edison Co., then went to Weston. He almost left after a year; he had been working in the standards lab for the firm's thermometry operations and wanted to get back into electronics. In the nick of time, Weston opened an electronics lab and Hartz stayed. When he left at the end of May last year, he was head of the radio test gear engineering group.

Hartz is a sincere man, a serious engineer, with a forceful and direct approach to management. Mrs. H. says he's a realist, not an optimist; yet he's already planning to outgrow M-E's new 3,000-sq ft plant, hire new people, expand the firm's instrument line. All this is on the basis of two costly proprietary items—"if we'd figured on a recession," he admits, "we might have picked different products to start with."

Leisure time has been a scarce commodity for the Hartzes in the last year. What there is of it they plow in at home with their three children, two teenagers and a 10-year-old. Hartz says he gave up fishing 20 years ago; these days even his cellar workshop gathers dust. He still reads avidly, insists on an hour or so with a novel or other light reading at bedtime "to separate me from my work."

COMMENT

Like as if . . .

It's bad enough to be bombarded with advertising about products that "taste good—like a cigarette should."

But to read (in Electronics Newsletter, p 7, Aug. 15) of a physicist saying "Like in zoology, we've got a new animal . . ." is

most irritating. One doesn't necessarily expect an advertising copywriter to speak accurate English, but an educated man should.

For the record, *like* is a preposition, not a conjunction. "As in zoology," or "as a cigarette should" is the correct form.

M. L. Mason
Middlebury, Vt.

We don't want to quibble, of course, but American English has no correct form, only standard ones. The form used is not standard, true; but then Physicist J. A. Simpson put the words into our mouth.

Nose Cone Research

The excellent rundown on the nose cone "packaging problem" ("Solving Reentry Problems," p 13, Sept. 5) failed to mention who undertook the solution. There is a glancing reference to GE in the next-to-last paragraph, and that's all. Who did the work?

J. S. Carberry
El Paso, Tex.

. . . (The article) mentions "arc-discharge hypersonic guns which can speed a projectile to 60,000 fps for free-flight studies."

Who is conducting this research?

Thomas Davis
Silver Spring, Md.

General Electric's Missile and Space Vehicle department in Philadelphia and Avco Research & Development Labs in Lawrence, Mass., are the chief research centers for this work. The hypersonic gun is one of the test tools at the GE labs in Philadelphia, where the Atlas cone was developed.

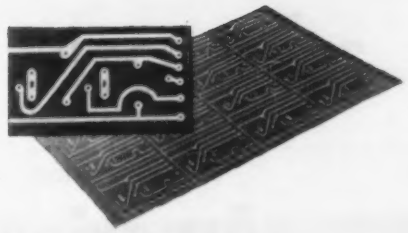
Inspection for Disarmament

We enjoyed reading the fine article "Can Electronics Check Peace?" (p 15, Sept. 5) . . .

Would you please bring to the attention of your readers that the book mentioned in the article, *Inspection for Disarmament*, edited by Seymour Melman, is available from Columbia University Press, 2960 Broadway, N. Y. 27.

Beth Dorrell
Columbia University Press
New York, N. Y.

cold-punch 'em fast without the cost of fixed dies!



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As fast as the operator places the Duplicator stylus in each template pilot hole, the printed circuit board or other work is automatically positioned under the Fabricator punch and the punch tripped. Anyone can learn to operate the Fabricator-Duplicator in a few minutes. Consistently clean holes are produced in laminates from paper base phenolic to glass base epoxy, copper clad one or both sides from .032" to .125" thick — without cracks. Tool changes are made in a few seconds, using Strippit interchangeable standard round, obround, square or special-shape tools.

BUT WHY NOT SEE the Fabricator-Duplicator — and the time-saving new Dupl-O-Scope template-punching attachment — perform on your work at your plant? Write today for complete literature and a demonstration by a Strippit mobile unit! Warehouse stocks in Chicago and Los Angeles for fast deliveries.

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America has homework to do!

THERE'S PROBABLY a lot about your town that makes you want to brag a bit about it.

But there's one thing you *can't* be proud of. And it's a shame you share with just about every other community in America.

The homes where far too many people live are a disgrace. Slums, semi-slums, housing blight are with you. Fixing them up is the homework to be done.

If your town is like most in the U. S., here's what the figures show: 1 out of every 10 homes are rock-bottom slums. Nearly one-half urgently need basic repairs.

But slums are something that is happening on the other side of town, you may say. The problem isn't mine.

Slums are YOUR homework

Distance is no barrier against the threat and cost of housing blight.

Your taxes go up because it takes more money for your town to fight the diseases and delinquency and poverty spawned in the slums. The security of your family goes down because the slum is the natural parent of crime.

Where your business comes in

Every firm has a responsibility toward the town where it's located. Part of it is to support community improvements as any other good citizen would.

Some slums are beyond repair. They must be torn down and a fresh start made. Others can be made to conform to accepted living standards. So it is up to you to get behind every sound program which seeks to provide adequate housing for all our people.

Civic and individual groups must have business backing . . . *your* firm's backing if they are to succeed.

Follow the course of Action!

A group of Americans from every walk of life has joined together in a non-profit organization to combat home and community deterioration, A.C.T.I.O.N., the American Council To Improve Our Neighborhoods.

Send today for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It lists booklets, research, check-lists, and other material which can help you. Address P. O. Box 500, Radio City Station, New York 20, N. Y.

ACTION

American Council To Improve Our Neighborhoods

electronics
business issue
OCTOBER 3, 1958

Operator observes plug-in panel which checks engine performance of GM's Firebird III as our industry ponders . . .

Electronics In Tomorrow's Cars

Detroit is making studies to find ways of using electronics to steer, control and protect the future's mass market auto. There are still some bumps in the road, but the light is green

ANNOUNCEMENTS this month of 1959 auto models draw attention to the growing potential of electronics in the American automobile.

Besides the radio and the increasingly more common headlight dimmer found in the present car, planners are thinking about new electronic applications for vehicle steering controls, radar warning systems, electroluminescent interior lighting, and electronic ignition systems.

Case in point is General Motors' gas turbine car, Firebird III (photo) unveiled last week. It has an electronic speedometer, tachometer, fuel gage and steering controls. It uses more than two miles of electrical wiring, includes two a-c generators driven by a separate accessory drive engine.

Spokesmen for the experimental car point out, however, that these, as well as other electronic accessories in the Firebird III, are still in the demonstration phase, and have been built into the vehicle primarily to show that certain mechanical functions can be performed electronically.

In spite of this, certain of the "blue sky" aspects of the car will be finding their way into production

autos. Already some Detroit spokesmen are talking frequently of a-c generators. They have been successfully used in trucks and marine engines.

As increased use is made of a-c generators, the use of rectifiers to convert a-c to d-c is said to be certain to follow. One manufacturer, whose present sales of semiconductors to the auto industry is limited mainly to auto radios, says engine temperature effects on rectifier operation are already being studied by his firm.

Further increase of semiconductor sales is seen as transistors become increasingly important to car radios. Most of next year's radio models will contain at least one power transistor.

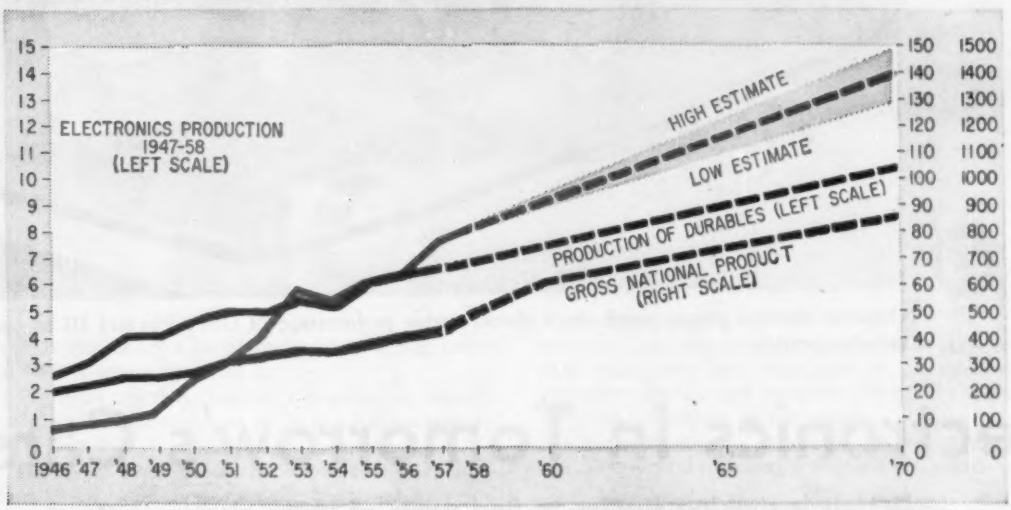
One firm supplying auto manufacturers as well as retail car radio stores says it will add an additional driver transistor to new models in about 50 percent of its output.

Twenty years ago, according to Electronic Industries Association, 800,000 car radios were sold. Last year's sales totalled 5,496,000. Predictions for next year range between five and six million. This estimate is for radios sold directly to manufacturers for installation in new cars at the factory. An anticipated one million more will be sold to retailers.

There is little talk in radio circles of any great production or sales endeavors for f-m, hi-fi, or stereophonic car radios.

Another here-and-now development in electronics for autos is a device which automatically changes the angle of the rear view mirror to reduce glare from following headlights. A second light-sensitive unit dims headlights in response to oncoming vehicles. It also does the same thing in response to tail lights of vehicles being followed. The headlight dimmer which uses transistors and miniaturized circuits will be installed as optional equipment in five 1959 auto lines.

PRODUCTION and SALES



(All vertical scales' figures in billions of dollars)

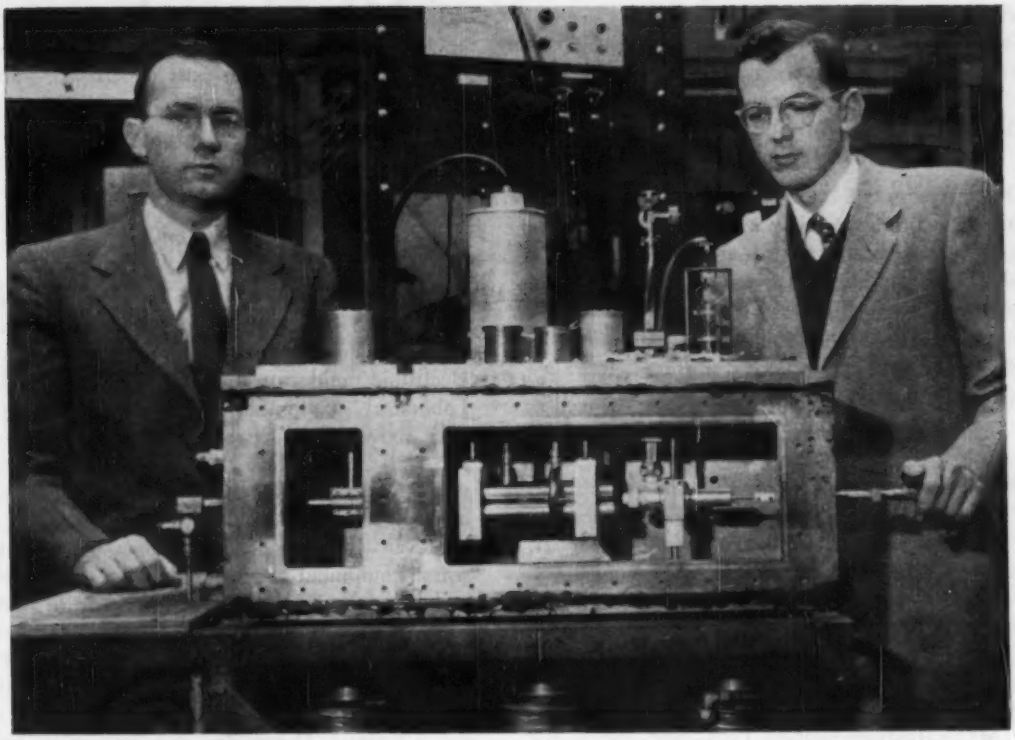
Electronics Growth Tops Nation's Pace

ELECTRONICS production has grown faster and probably will continue to grow faster than gross national product. Electronics curve above shows that the industry's annual output at factory door prices and, excluding broadcasting revenues, distributor markup and repair services, has jumped from less than a billion dollars in 1947 to almost eight billion in 1957.

Gross national product, known to economists as GNP, is the total of all goods and services produced. Because it includes services, graph above also has a third curve which compares electronics production with the production of durable goods only. This curve shows the totals for items such as appliances, machinery and other hard goods. It provides a better comparison since both it and the curve for electronics production exclude services. The electronics curve rises more sharply than the durables curve.

Projections for the future based on electronics' past growth vary from a low of $9.1 billion in 1960 to a possible high of $9.7 billion. Same growth rate shows totals by 1965, barring war or major technological breakthroughs, between $11 billion and $12.5 billion. It also indicates at least $12.8 billion electronics production by 1970, possibly as high as $15 billion. Growth of electronics has been steeper than rest of economy because it is a comparatively young industry. But with defense emphasis on electronics certain to continue, there's no leveling off in sight.

The climb can be expected to continue.



Components needed for the increasing volume of prototype gear made in university labs—like maser at Columbia—is one reason why our . . .

College Market Grows

Increased research work by educational institutions creates sales. Replacing of permanent test and experimentation gear goes on. New devices are being purchased as prototype work mounts

THOUGH COLLEGE and university laboratories are not going into the production business, a sizable quantity of electronic gear is now being built in them.

Some of it is put together as a means of obtaining data called for in a contract; this gear never leaves the lab. Other devices are built and turned over to a military contractor for analysis. And some—equipment for rockets and satellites, for example—is built as the end product for military operational use.

Size of this market to date is a big portion of the $100 million a year the Dept. of Defense is spending for research with nonprofit educational institutions.

USAF's Air Research and Development Command has authority to sign contracts amounting to $35.2 million in fiscal year 1959. Last year, 243 educational labs got 619 contracts. This year, more contracts will be let to more laboratories.

Navy is authorized to obligate $43 million this year. Work will be divided among more than 200 labs and 1,500 contracts.

Army's obligations in fiscal 1959 will probably surpass the $20 million spent with 123 colleges last year.

Here's what some of the laboratories are doing:

Pennsylvania State University is building both airborne (see cover photo) and ground instrumentation for Jupiter C rockets under a $150,000 contract with Army Ballistic Missile Agency. Purpose is to obtain accurate data on electron densities which cause errors in tracking missiles and satellites by radio. Part of ground-based gear will be installed in a trailer at Cape Canaveral. A 1,000-ft radio antenna will be

erected at another site in Florida.

State University of Iowa built most of the scientific instruments aboard Explorers I and III and all of the electronic nest of scientific instruments for Explorers IV and V. An SUI graduate student built the tape recorder for Explorers II and III.

Other equipment built at SUI includes: an electronic test-scoring machine; a device that can focus four ultrasound beams from four separate irradiators inside the human brain on a target no larger than the diameter of a pencil lead (used to treat Parkinsonism); and an electronic, preset interval timer for use in psychology labs.

SUI also builds rocket instrumentation, as well as the rocket itself, for firing at the University's IGY base at Fort Churchill.

Massachusetts Institute of Technology's various labs have been making breadboard contributions to the three services since before World War II. Lincoln Labs, with over 2,000 employees, has developed radar (its frequency diversity radar is now being procured for air defense work), communications, electronic computers and SAGE. The lab has contributed to DEW line and Texas Tower installations. Work on tropospheric scatter is being carried on with MIT's Instrumentation Labs—best known for Charles Draper's early development of inertial guidance. With its staff of 700, the Instrumentation Labs section is also engaged in instrumentation for a photographic reconnaissance satellite to orbit around the planet Mars.

Research Laboratory for Electronics, which absorbed most of the work and projects of the wartime Radiation Lab at MIT, is currently expanding its efforts in the areas of communications science and information theory. Other work includes microwave spectroscopy, solid state physics, microwave electronics and microwave gaseous discharges.

Following are some current projects, contracted by Army Signal Research and Development Lab, Fort Monmouth, N. J. During the course of these projects electronic gear will be built for either lab use or delivery to the military for analysis.

New York University (staff of 445 employees): (1) instantaneous analyzer for use with receiver system; (2) panoramic display of frequency versus time.

University of Michigan: (1) "Project Michigan," electronic surveillance devices; (2) demonstration of various types of electronic networks for military applications; (3) instrumentation for rockets for upper atmospheric research in the Arctic; (4) microwave radiometry detection techniques; (5) test batteries; (6) low flicker noise in tubes; (7) experimental magnetrons, backward wave oscillators.

Stanford: (1) microwave research project; (2) design of parameters of ground-based antennas; (3) research on electronic circuitry; (4) special experimental tubes for military applications; (5) two-level high power maser. **University of Arizona:** transistorized distributed amplifiers.

University of Illinois: (1) parts of receivers are built at the University Lab for R&D project for comparing reception of signals transmitted from Fort Monmouth to the moon and by tropospheric scatter; (2) radar-communications networks; (3) microwave duplexer switching mechanisms.

Ohio State University: advanced development of antennas. **University of Syracuse:** radar sensors and associated devices. **Illinois Institute of Technology:** electronic rapid-scan antenna. **Columbia Radiation Laboratory, Columbia University:** maser (photo, p 15, shows maser between developer C. H. Townes, left, and graduate student). **University of Pennsylvania:** research on free radicals, experimental samples of new crystals.

Stevens Institute of Technology: experimental research equipment to provide data for work on plasma acceleration. **University of Wisconsin:** antenna evolved from surface wave transmission lines, experimental equipment. **University of Rochester:** frequency synthesizer and transistorized i-f amplifier.

Princeton: plastics research, samples of new materials. **Rutgers University:** new ceramics. **Lehigh:** samples of new lightweight metals. **Polytechnic Institute of Brooklyn:** millimeter wave guide components.

Simulator Starts Work

New 26-ton flight trainer for United's DC-8 jet transports uses closed-circuit tv for visual display. Developed by Link Aviation, trainer duplicates electronically all aspects and conditions of flight

Counter-ICBM Spending Due

Recent R&D progress plus a fiscal 1959 Nike-Zeus appropriation of $262.7 million indicates that some long-lead time production and advanced development contracts are in the works

FIRST TACTICAL antimissile defense against the Soviet ICBM, the Nike-Zeus countermissile system, is moving rapidly now from the research and development stage to advanced development and production.

Defense Department says the total spent on R&D before this fiscal year is classified information. However, it is known that slightly more than $50 million worth of contracts were let to Western Electric Co., prime contractor, with pre-fiscal 1959 funds.

It's a good bet now that one or more large contracts will be announced soon. Here's why:

For fiscal 1959 Congress approved $262.7 million to carry forward the Nike-Zeus program. All but $20 million for "blue sky" research by the Advanced Research Projects Agency is in the Army's budget. This means that $242.7 million in Army funds should be available for advanced development and hardware procurement, including forward acquisition and local radars, the computers and the missile system. However, ARPA's now supreme position in the antimissile field means that it retains overall supervision of Army spending on Nike-Zeus.

Guesses on missile-borne and ground electronics run from 20 to 40 percent of the hardware total, or $50 to $100 million out of fiscal '59 funds.

An aide to Defense Secretary McElroy indicates that the administration has felt that a certain development stage had to be reached in the Nike-Zeus program before new spending would contribute to the speed of the project.

"The speed with which we spend money on Nike-Zeus is determined solely by the speed of development of the research program itself," he told ELECTRONICS. "We see no way to spend more money wisely to speed this thing up."

However, a DOD spokesman said that the Nike-Zeus program has been "considerably expanded" recently, even though new contracts have not been announced. "Contracts will be increased," he added.

The House Committee on Appropriations has received estimates that the N-Z system will cost "on the order of $4-$5 billion when finally deployed and operational."

From an Army spokesman ELECTRONICS got this report: Nike-Zeus is "off the drawing boards" and some "component hardware" is already in existence. "Better than 50 percent" of the component hardware in the Nike-Hercules ground-to-air missile system will go into Nike-Zeus. Last April the Army said it would go into a production program beginning in the latter part of 1959, if fiscal '60 funds permitted.

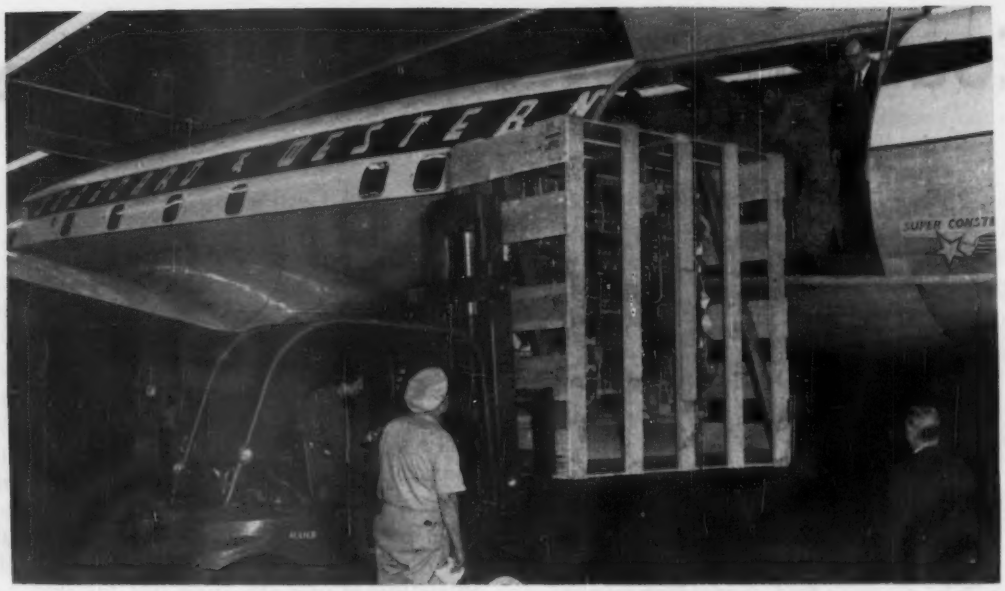
There was also this indication that the research portion of the Nike-Zeus program was far along:

Roy W. Johnson, director of ARPA, told a House committee hearing last April that his examination of the status of Nike-Zeus when he took charge of the new agency convinced him that it was "past the research point." Much of the Nike-Zeus money in the fiscal '59 budget, he said, was for "long-lead time production and construction."

Scientific management of the entire ballistic missile defense program, of which the Nike-Zeus is a part, is linked to staff work by the Advanced Research Projects Division of the Institute for Defense Analyses, directed by Herbert F. York. He is also Chief Scientist of ARPA. IDA is a nonprofit corporation jointly sponsored by a number of universities; it has contracts with the Defense Department, including one providing for the operation of Advanced Research Projects Division.

The administration's cautious attitude on anti-ICBM spending seems to add up to this: Let's spend money only for Nike-Zeus right now because we need an anti-ICBM weapon fast, and this one fulfills the requirement and is farther along than any other. But let's not spend money on N-Z any faster than technical considerations warrant. Let's also be flexible enough so that if a major breakthrough should come about through ARPA or in the development of another missile, we can incorporate an advanced feature into our anti-ICBM system before committing too much money to present state-of-the-art hardware.

This thesis is supported by Herbert York's words to a House subcommittee on appropriations: "We hope that much of the research that we do will be of such a nature that the items that are invented can be substituted into the Nike-Zeus system. **Insofar as possible, we would like to build onto the Nike-Zeus system.** If that is not possible, then there may have to be some new system that entirely replaces it, but that remains for the future to determine."



Lift truck loads fragile equipment on cargo plane, as growing activity is seen in. . . .

Shipping Electronic Products

As our industry produces more goods, the business of getting them to market gains importance in the eyes of men who do the job

KEEPING PACE with the growth of the electronics industry is the business of transporting its products.

According to men who move the goods, more trucks, planes and even busses will be carrying electronics cargoes next year than ever before.

Taking part in this growing area of activity are a number of firms who at one time were occupied solely with moving household goods. Representative of increased activity are figures from Allied Van Lines. In 1950, AVL's revenue from shipments of electronics came to about $250,000. By 1955 this rose to $1 million. Last year's total came to $3½ million.

Electronic equipment handled by moving vans travels under a special section of ICC regulations. The rates in this category are about $1.25 per hundredweight cheaper than household goods. Total costs of shipments depend on weight and mileage. Further advantage to the electronics shipper willing to pay for the service is the exclusive use of the van moving his cargo. Ordinarily partially filled vans are held for additional cargoes. Shipper pays extra for exclusive use (at the rate of seven pounds per unoccupied cubic foot), but many firms do this willingly when speed is important.

Airlines also report growth in revenue from electronics shipments. A spokesman for Pan American says electronic gear is "one of the fastest growing classifications" in his firm's clipper shipments.

Estimates from air freight handlers are that this year cargo values on shipments of electronics ranged from second to sixth in importance. (Other major classifications for air shipments are household goods, machinery, livestock, perishables and textiles.) American Airlines rates electronics as one of its three largest cargo types. Seaboard and Western Airlines spokesmen report a similar standing.

Synthesizing facilities of air and surface transport, Railway Express Agency points to long-time interest in electronics. Major emphasis is placed on packaging fragile components and assemblies for best protection against breakage on long-range hauls.

Consultation with manufacturers by REA men has resulted in a large variety of special containers, label designs, and handling techniques.

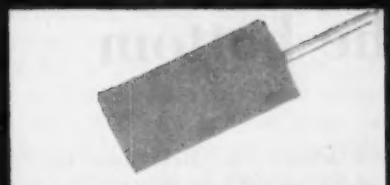
Smaller shipments, often of an emergency nature, are being handled with increasing frequency by Greyhound. Company officials say they do not keep reports of commodities by classification, but report that "a significantly increasing number" of electronics firms are using their intercity facilities.

Electronic items most frequently handled, firm says, are replacement parts for medical electronic equipment and radio and tv transmitters.

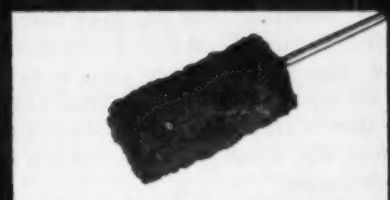
CIRCLE 8 READERS SERVICE CARD→

YOU GET STABLE PERFORMANCE

High capacitance value in small package provided by TI precision formed pellet.

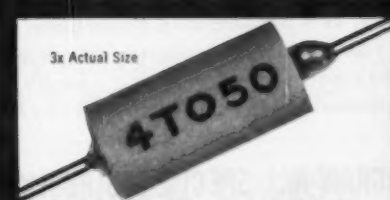


Safe dielectric stress is determined by anodized coating of tantalum pentoxide.

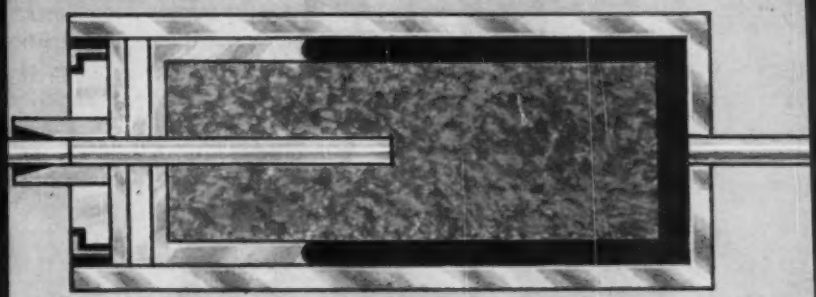


Solid MnO_2 electrolyte cannot leak.

Positive bond to solder base for cathode connection assured by copper coating.



Mounts in any position . . . hermetically sealed, metal case is shock resistant.



...with precision built

tan-TI-*cap**

solid tantalum capacitors

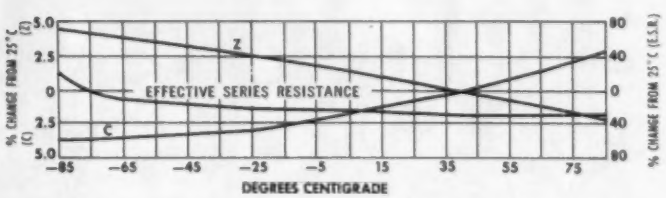
You are assured of precision electrical performance throughout extra long storage and service life by TI advanced construction techniques and high purity materials in *tan*-TI-*cap* capacitors.

tan-TI-*cap* capacitors are ideally suited for use in transistor and other miniature circuit applications . . . firmly anchored leads can be bent sharply close to the case for easy mounting.

Stable electrical characteristics remain within narrow limits throughout temperature range (−80° to +85°C).

*Trademark of Texas Instruments Incorporated

SELECT FROM 17 RATINGS . . .					
6-Volt	22 μf	33 μf	47 μf	60 μf	200 μf
15-Volt	10	15	22	33	100
25-Volt	5	10	15	35	55
35-Volt	4	8			



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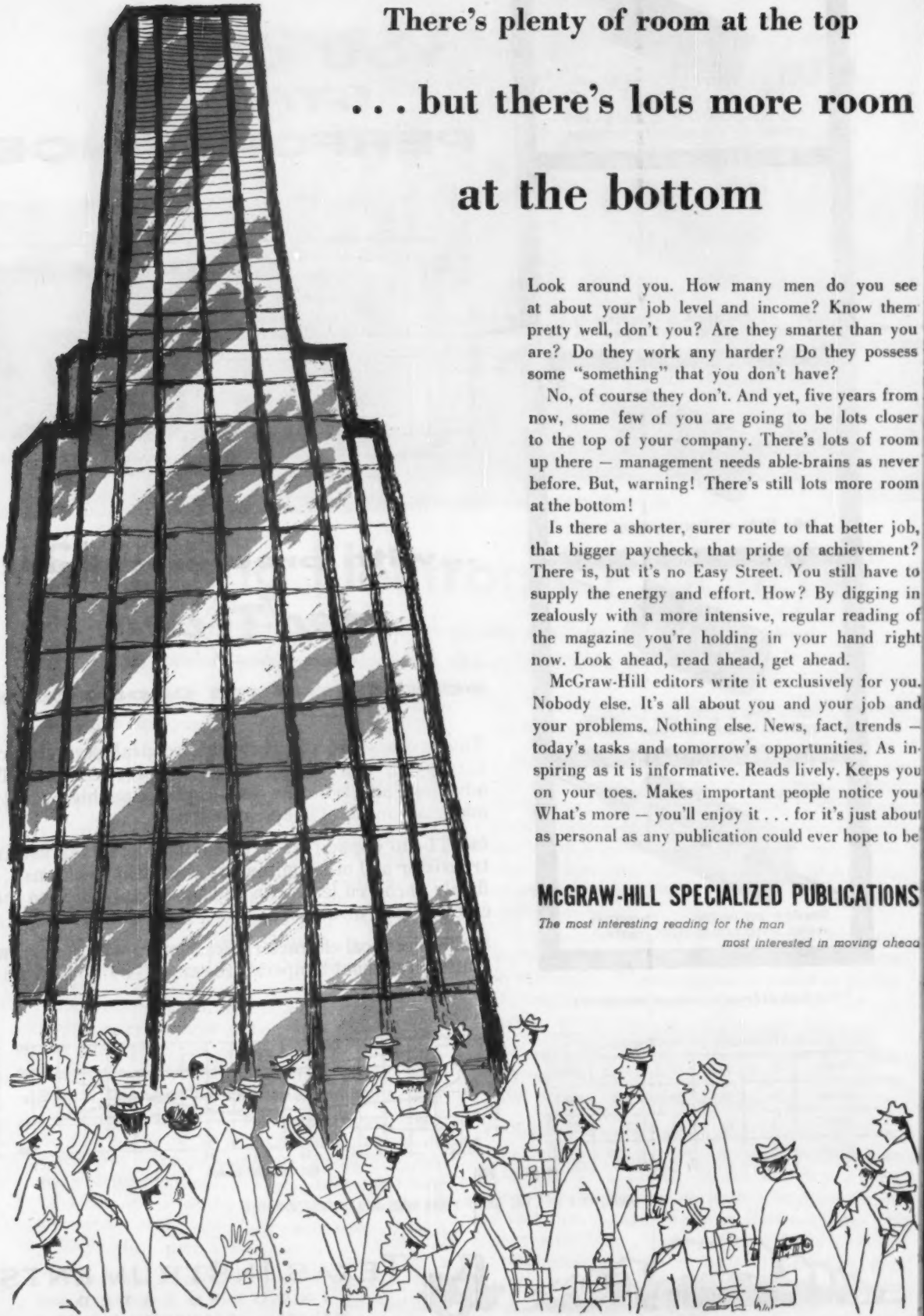
CIRCLE 8 READERS SERVICE CARD

There's plenty of room at the top

. . . but there's lots more room at the bottom



Look around you. How many men do you see at about your job level and income? Know them pretty well, don't you? Are they smarter than you are? Do they work any harder? Do they possess some "something" that you don't have?

No, of course they don't. And yet, five years from now, some few of you are going to be lots closer to the top of your company. There's lots of room up there — management needs able-brains as never before. But, warning! There's still lots more room at the bottom!

Is there a shorter, surer route to that better job, that bigger paycheck, that pride of achievement? There is, but it's no Easy Street. You still have to supply the energy and effort. How? By digging in zealously with a more intensive, regular reading of the magazine you're holding in your hand right now. Look ahead, read ahead, get ahead.

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ENGINEERING REPORT

Height Finding Radar Is Under Study

HEIGHT FINDING RADAR is understood to be under study by the armed services and the Airways Modernization Board. Rapier, a secondary radar developed by Bendix Radio, reportedly can determine the height of planes within 1,000 ft. It's part of a three-dimensional radar system and consists of a high-gain antenna array that rotates synchronously with primary air surveillance radar. Each antenna element has its own r-f amplifier right at the antenna. Reception pattern consists of a group of lobes. Effective range is said to suggest its possibilities in an early warning air defense system and in air traffic control.

RUSSIAN INDUSTRIAL INSTRUMENTS that are high in quality have been produced at a rapidly increasing rate since 1950. So says a 13-man group of engineering society members which recently visited the Soviet Union. Using an index of 100 based on 1950 production, the Soviets gave these figures: Total instrument output was 315 in 1955 and 414 in 1956; industrial instrument production was 334 in 1955 and 462 in 1956. Russians say transistor output index hit 860 in 1955, is projected to 20,500 by 1960. According to the group's first report one Russian plant turned out a potentiometer-recorder every three minutes and 40 seconds. Group's general impression: The Russians seem well advanced in control theory but trail the U. S. in applications.

NAVY SKYHOOK BALLOONS will soar to 120,000 ft to investigate cosmic rays in the region of 10,000 bev under a $450,000 grant just announced by the National Science Foundation. Scientists believe that elementary particles at these extremely high bev energies react according to laws which differ from those to which low bev energy particles conform. Pressurized, light-tight gondolas attached to the balloon will contain stacks of photographic sheet emulsion, each of which measures about 2 ft by 1½ ft by 1 ft, or five times the size of stacks sent up previously. When a proton or other outer space particle enters the stack, it collides with a heavy atomic nucleus in the emulsion. Result: a nuclear explosion releasing high-energy particles that strike other nuclear targets and produce a whole series of new reactions, all recorded on the stacks. Flight data may have bearing on the desirability of building larger accelerators.

NEW CONCEPT OF BASIC RESEARCH in spurring military technology was voiced this month by an official of the Advanced Research Projects Agency. Lambert L. Lind, Jr., special assistant to director Roy Johnson, said the powers given ARPA mean that "for the first time the Defense Department is prepared to sponsor pure research against the judgment that it might lead to a valid military application without proving the judgment in advance." He also declared that research in areas of interest to all the services cannot be limited to a portion of our laboratory skill that happens to be employed by a single service or a single company.

TECHNICAL DIGEST

• **Circular mirror** mounted on air turbine rotating at 21,000 rpm spins off moisture and other particles by centrifugal force to give permanently clear mirror surface. Technique has been successfully applied to dental mirrors by Super-Dontic Mfg. Co., using bearings made by Miniature Precision Bearings, Inc. Mirrors and lenses of photoelectric systems may also be designed for centrifugal cleaning.

• **Cadmium-selenide** photosensitive diode mounted at bend in output waveguide of 8,000-mc Philco scatter system detects presence of waveguide arcs either toward output line or klystron and initiates automatic shut-down of klystron beam potential.

• **Aircraft** radome damage by lightning is minimized by placing strips of ¾th-inch-wide adhesive-backed aluminum tape 0.003 inch thick on outside of radome about 18 inches apart. Each strip is grounded by runing end under radome mounting bolt. Tests at Lightning and Transients Research Institute showed that lightning goes directly to one of protection strips rather than through radome to metal parts inside; strip then vaporizes without damaging skin of radome. Only repair needed is application of new tape strip.

• **Impression** of color can be obtained on ordinary black-and-white television sets merely by running special film at transmitter, in which contrast of successive frames in a recurring series of frames is varied as described in recently issued U. S. patent 2,844,990. Technique is based on Fechner-Benham effect: if tomato is black in first three frames, transparent in next three and cross-hatched in next, repetition of this seven-frame sequence at normal rate of one frame per television scanning period will make tomato appear red to viewers. Definition and color accuracy are claimed adequate for cartoons and commercials using line diagrams.

Gage Aids Launchings

Thermistor, being inserted in hypsometer flask, measures vapor temperature of low-boiling point liquid. This temperature is then used in computing atmospheric pressure

ELECTRONICS is combined with a long-known principle in an instrument said to measure atmospheric pressure at upper altitudes with greatly improved accuracy. Called the hypsometer, the device is being incorporated in radiosondes made for the Signal Corps by General Instrument.

Primary purpose of the new radiosonde is to sample weather data 15 to 25 miles above missile launching sites. Data from the balloon-borne radiosondes is telemetered back to earth to aid in judging conditions for missile and satellite launching.

The instrument will also be used for IGY studies and may eventually find its way into general weather forecasting.

The hypsometer radiosonde contains all the instrumentation of current radiosondes. This includes transducers to measure humidity and temperature and a bellows to measure atmospheric pressure. Telemetering equipment is also incorporated to radio the information back to the ground.

The hypsometer is added to the other instruments in the new radiosonde. This instrument is based on the old principle of determining altitude by measuring the boiling point of a liquid.

The hypsometer takes over from the bellows to measure atmospheric pressures at heights of 15 miles and up. At these altitudes, the lower pressures make the bellows device inaccurate.

The hypsometer is a two-inch long flask and is filled with 5 cc of carbon disulphide, which boils at a very low pressure and temperature. At about 60,000 ft, altitude the liquid inside the flask starts boiling. As the balloon rises, temperature of the boiled-off vapor drops rapidly.

A thermistor inserted in the neck of the flask takes continuous readings of temperature inside the flask. These readings are telemetered back to the ground. Outside air temperature is also being measured and sent back.

Given air temperature and temperature inside the flask, meteorologists can almost instantly compute both atmospheric pressure and altitude.

Color Tv Projects Surgical Procedures

Operations and other clinical procedures will be shown to doctors and medical students with a special Marconi color television system. The projector shown here provides a 6 by 8 ft picture that can be seen by up to 300 people

MEETINGS AHEAD

Oct. 6-8: Symposium on Extended Range and Space Communications, IRE and George Washington Univ., Lisner Auditorium, Wash., D. C.

Oct. 8-10: IRE Canadian Convention and Exposition, Electronics and Nucleonics, Exhibition Park, Toronto, Canada.

Oct. 13-15: National Electronics Conf., 14th Annual, Hotel Sherman, Chicago.

Oct. 14-15: Institute of Printed Circuits, Fall Meeting, Chicago.

Oct. 20-21: Aero Communications Symposium, Fourth National, PGCS, Hotel Utica, Utica, N. Y.

Oct. 20-21: USA National Committee, URSI Fall Meeting, Penn State Univ., University Park, Pa.

Oct. 20-24: Society of Motion Picture and Television Engineers, 84th Convention, Sheraton-Cadillac Hotel, Detroit.

Oct. 26-31: American Institute of Electrical Engineers, Fall Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa.

Oct. 27-28: Aeronautical and Navigational Electronics, East Coast Conf., Lord Baltimore Hotel, Baltimore.

Oct. 29-30: Computer Applications Symposium, Fifth Annual Meeting, sponsored by Armour Research Foundation, Morrison Hotel, Chicago.

Oct. 30-31: Aircraft Electrical Society, Pan Pacific Auditorium, Los Angeles.

Oct. 30-31; Nov. 1: Electron Devices Meeting, PGED, IRE, Shoreham Hotel, Wash., D. C.

Nov. 6-7: Prof. Group on Nuclear Science, IRE, Fifth Annual Meeting, Villa Hotel, San Mateo, Calif.

Nov. 17-20: Magnetism and Magnetic Materials, Fourth Annual Conf., AIEE, APS, IRE, AIME, OHR, Sheraton Hotel, Philadelphia.

Nov. 17-20: Radar Conference, Seventh Annual, Univ. of Miami, Miami Beach, Fla.

Nov. 19-20: N. E. Research and Eng. Mtg., NEREM, Mechanics Bldg., Boston.

Nov. 19-21: Electrical Techniques in Medicine and Biology, ISA, IRE, AIEE, Nicollet Hotel, Minneapolis.

Jan. 29-30: Long-Distance Transmission by Waveguides, IRE, London, England.

Freddie, the freshman ... aged 40

More pencils, more books — management men are on their way back to school. Hold 'em Harvard! Fight, Stanford, fight!

As American industry marches on to greater achievement, its leaders have been the first to recognize the need for such "refresher" courses. But management has moved at such a clip, it has outdistanced its own replacements — its ranks of officer material have never been so thin.

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Properties of Fluorogases

	SF_6	C_3F_8	C_4F_{10}	C_4F_8
Mol. wt.	146.06	188.02	238.03	200.03
B.P., °C	−63.8 subl.	−36.7	−2.0	−6.0
F.P., °C	−50.8	∠ −160	∠ −80	−41.4
Rel. Dielect. Strength	2.2	2.2	2.8	2.8

Hot Gas Insulators

Tests of three perfluorocarbon gases indicate gas-filled transformers can get 100 C hotter

SEVERAL PROMISING gaseous dielectrics, with preliminary temperature ratings 50 C to 100 C higher than sulfur hexafluoride, were reported recently at the NEMA-AIEE National Conference on Application of Electrical Insulation in Cleveland.

Gaseous dielectrics, chiefly SF_6, are being used in place of air in radar and television transmission, in waveguides and coaxial cables, and also in tv multiplexers, x-ray machines, electron particle accelerators and transformers.

Properties of octafluoropropane (C_3F_8), perfluorobutane (C_4F_{10}) and perfluorocyclobutane (C_4F_8) were described by F. L. Holloway and W. H. Mears of Allied Chemical Corp., and F. W. Blodgett of DuPont. The gases are available in experimental quantities.

The perfluorocarbons are heavier than sulfur hexafluoride and have considerably lower vapor pressures. Dielectric strength of octafluoropropane equals sulfur hexafluoride, while the other two have 25 percent greater dielectric strength. Their dielectric strength overage improves in comparison with sulfur hexafluoride with increasing gap distance in non-uniform fields, Holloway and Mears said.

More important, they added, are tests which show that the perfluorocarbons are compatible with other component construction materials and are thermally stable.

The maximum temperature recommended for sulfur hexafluoride is normally 150 C. The perfluorocarbons would be suitable for a range of 200 C to 250 C and could be used in high-temperature, high-voltage apparatus.

Blodgett reported breakdown voltages for perfluorocyclobutane which are 2.5 to 7 times that of air at varying gaps and voltages. The best results were obtained in non-uniform fields. Dilution with nitrogen increases the range of temperature and pressure in which it is stable.

It will not attack magnet wire enamel even if sprayed on as a liquid.

Applications under investigation include miniature transformers in pressure cells with the gas as a refluxing evaporative coolant. Low power factor and ability to suppress corona, Blodgett said, can allow the gas to be used as a lightweight filler for waveguides and cables.

Makes Zinc Foil By New Method

ZINC FOIL in five mil to one mil thicknesses can be made by an electrolytic process, according to American Smelting and Refining Co. The firm is producing foil 26 inches wide in a pilot plant.

Asarco says that the electrolytic foil costs less to make and is of higher purity than foil produced by metal rolling. Its price is expected to be below that of copper and aluminum foil.

In production, zinc is deposited electrolytically from a zinc sulfate bath onto a revolving drum and then stripped from the drum in a continuous sheet.

High density polyethylene (right) flames while sample (left) of . . .

New HDP Won't Keep Burning

PRODUCTION of flame-resistant high-density polyethylene (HDP) in a variety of colors is announced by W. R. Grace & Co. The plastic is reported by the firm to have electrical characteristics almost as good as the firm's standard HDP and equivalent physical characteristics.

The plastic will burn if placed in flame or subjected to arcing or corona discharge. However, it will extinguish itself immediately when heat is removed. The test used was a 30-second application of a Bunsen burner flame.

First electronic use is as television tube yokes. High-voltage socket and insulator applications are anticipated. Introductory bulk price for flame-resistant HDP is 51 cents a pound.

Other recent plastic announcements include:

• Naugatuck Chemical division of U. S. Rubber is starting production of a polyester which will withstand sustained temperatures of 500 F (260 C) and brief exposure to 1,000 F. The firm says the polyester's radar transparency is high and that it is in limited use as a radome material on jet bombers.

• Eastman Kodak and Humble

Oil and Refinery Cos. will join the ranks of polypropylene producers. Chemical Week, a McGraw-Hill publication, says industry sources predict that U.S. production of polypropylene may rise to 350 pounds a year by 1965.

• Emerson and Cuming is making glass spheres 30 to 300 microns in size. They are reported to be physically and electrically stable up to 1,550 F (850 C). The spheres are used as fillers in lightweight casting, pack in place and machinable foam plastics. A 3,000 F class of sphere is in experimental production.

Ceramic Slugs

Slugs of thermoelectric material are being experimentally made by Westinghouse from pressed ceramic powders. Firm says ceramics are made from common materials and may make thermoelectric conversion practical. Unlike semiconductor crystals, the ceramics can be used at high temperatures, 2,000 to 3,000 F. Company says that the ceramics are inherently stable and have shown promising thermoelectric conversion efficiencies

Orders Tubes

SIGNAL CORPS estimates it will purchase 3.392 million electron tubes for maintenance purposes during fiscal 1959. The procurement list contains 201 standard tube types, in quantities of 50 to 361,050 tubes. Types 1L4, 12AU7, 2C51, 12AX7 and 12AT7WA all were purchased in quantities of more than 100,000.

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ESSEX DELAY LINES ARE NON-FLAMMABLE!

Essex modular Delay Lines provide greater freedom, versatility, and latitude because these compact units can be mounted both horizontally and vertically — stacked in series on common mounting screws for higher delays.

Essex provides lines from a fraction of a microsecond to several thousand microseconds delay . . . impedances from 50 to several thousand ohms . . . bandwidths up to 25 MC.

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ESSEX ELECTRONICS

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Navaho: A Helpful Ghost

Knowledge and hardware obtained from the cancelled Navaho missile project continue to pay off

KILLED IN JULY 1957 by a budget cut, the Navaho surface-to-surface guided missile system is proving to be a helpful and hard-working ghost.

Portions of North American's Navaho system—its guidance, its test vehicle (X-10), its test version (XSM-64), and the production model itself (SM-64)—continue to turn up in a wide variety of current and future weapon system programs.

Latest materialization is the XSM-64 launching at Cape Canaveral to gather information on aerodynamics and other aspects of supersonic high-altitude flight for developing the Mach 3, chemically-fueled B-70 and the F-108.

Known as RISE (Research In Supersonic Environment), the program calls for launching the remaining Navaho test and production missiles produced before the contract was cancelled. (About 12 had been turned out under a contract amounting to between $600-$750 million.) Only modification was addition of new telemetry instrumentation.

This application of Navaho is further indication that the B-70 and F-108 are all of the same structural family.

Another airframe derivative is Hound Dog, long-range missile to be launched from the B-52. "Its airframe," Gen. C. S. Irvine, Deputy Chief of Staff, Materiel, USAF, told the appropriations committee a while ago, "was the X-10 test vehicle for Navaho." (North American, however, says Hound Dog's airframe is "entirely new.") Another Navaho subsystem that will go into Hound Dog is its inertial guidance.

Besides missiles, Navaho's inertial guidance is also going into aircraft and submarines.

Bomb-nav system for Navy's attack plane, the A3J Vigilante, is an outgrowth of Navaho's guidance. And though designed to operate for an hour in Navaho, the system, with only slight modification, functioned for days in submarines *Nautilus* and *Skate* during their polar cruises. A refined version of the system will go into some of the Polaris subs.

Other important contributions to newer weapons resulting from work on Navaho include: progress in high-speed flight characteristics, solution of heat problems, ways of using titanium and other materials in aircraft and missile structures, and manufacturing methods.

Apart from direct incorporation of Navaho into newer systems, its test missile (X-10) is being farmed out as work horse for an unrelated project—to conduct high performance flight tests under a $500,000 contract to demonstrate weapon system capability of Bomarc.

Development of the booster rocket for Navaho gave birth to the first stage engine used in Thor, Jupiter C, Redstone and Atlas.

MILITARY ELECTRONICS

• **Navigation equipment** used in submarine *Seawolf* is "conventional equipment for a nuclear-powered work horse," Navy says. Gear includes: radar, loran, electromagnetic speed log (obtains speed through water), DRAI (dead reckoning analyzer indicator), gyro compasses, sonar and electronic fathometers.

• **More than 20** major system contracts for the B-70 and F-108 projects will be let within the next three or four months, North American's president J. L. Atwood said recently. "All will involve electronic applications."

Survey teams have already inspected facilities of prospective contractors in 90 cities. But bids will be accepted from all interested firms.

• **Newest Falcon,** the GAR-3, surpasses previous Falcons, GAR-1, GAR-1-D and GAR-2-A in altitude, speed and range, says prime contractor Hughes.

GAR-3 homes in by semiactive radar. (Target is illuminated by radar transmitter in the interceptor. Missile carries receiver and homes in on echoes.) GAR-1-D uses active radar homing (carries own transmitter) and GAR-2-A is an infrared homer.

Under development is Hughes' GAR-9, atomic missile to arm the F-108.

CONTRACTS AWARDED

Hughes gets a $30,689,713 contract with Army Signal Corps for production of certain elements of "Missile Monitor," Army field operations control center for overall mobile defense operation. Designated AN/MSQ-18, the system will tie in and coordinate airborne target information from Army radar to Nike missile batteries.

The contract will involve a monthly payroll of $800,000 at Hughes, $215,000 monthly external purchases in the Los Angeles area, and employment of about 1,600 people at maximum production.

Summers Gyroscope is awarded a $150,000 contract with prime con-

tractor McDonnell for electronic components of a guidance subsystem for the GAM-72 diversionary missile Quail.

Eastman Kodak wins four production contracts, totaling more than $3 million for: tv-optical bombsight for Navy's A3J attack plane, tv-optical head for the fire control system of USAF's B-52, a fuze for Navy's Sidewinder air-to-air missile, and a safety and arming mechanism for Army's ground-to-air Hawk.

Detroit Controls gets $4.5 million in contracts for: navigational system components for Polaris and Regulus submarines and for gyroscopic devices for USAF's F-106A interceptor, Navy's Terrier and Tartar surface-to-air missiles and Army Sergeant. For Polaris subs, Detroit Controls is responsible for a radiometric sextant and for line of sight stabilization for both photoelectric and radiometric sextants (ELECTRONICS, p 14, May 2).

Du Mont will design and develop a special, shortwave-length radar for BuShips under an $800,000 contract.

Telecomputing is awarded a $1,788,000 contract by Western Electric for production of rate and position gyros for Nike-Hercules.

Raytheon receives a $2,085,530 contract with Boston Army Ordnance District for repair parts for the Hawk missile. About 40 percent of the electronic components, such as resistors, capacitors, inductors, etc., will be bought from outside suppliers.

Ramo-Wooldridge is awarded a $2,828,297 contract with Army Signal Supply Agency for automatic data processing system test facility.

Boeing is awarded a $52 million contract by AMC for KC-135A jet tankers. Size of the contract is expected to reach $178 million when final negotiations are completed.

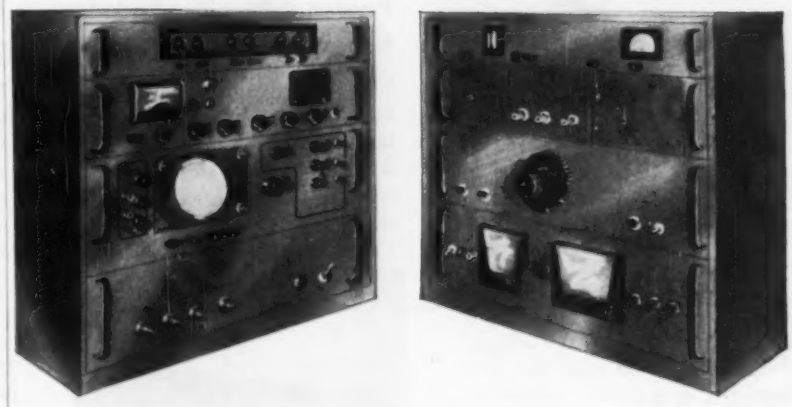
Servomechanisms receives orders amounting to $476,756 from Lockheed for production of true airspeed computers.

Progress in the Science of Chronometry

IN 1714, the British government offered a prize of £20,000 for any means of determining a ship's longitude within 30 nautical miles at the end of a six week's voyage. John Harrison, a self-educated Yorkshire carpenter, won the prize in 1760 with an accurate clock.

IN 1958, ICBMs and earth satellites created the need for new concepts in accurate timing. To fill this need, Hycon Eastern has developed an electronic Timing System with heretofore unattainable timing precision capable of operating anywhere in the world.

AN INTEGRATED TIMING SYSTEM FOR TODAY'S GLOBAL CONCEPTS



Solar or sidereal time is displayed visually and is available for input to automatic computers and indexing data with many types of recorders . . . magnetic tape, oscillograms, photographs and strip charts. Furnishing a time scale with resolutions available to one microsecond, this system is ideally suited for tracking and control of missiles, astronomical measurements, and navigation systems. Write for Bulletin TS-00.

HYCON EASTERN, INC.

75 Cambridge Parkway Dept. A Cambridge 42, Massachusetts

NEW PRODUCTS

Voltage Dividers three models

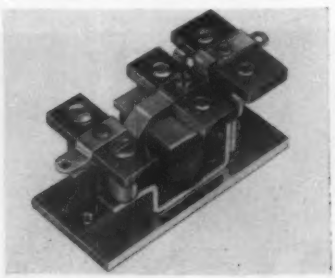
GERTSCH PRODUCTS, INC., 3211 S. La Cienega Blvd., Los Angeles 16, Calif., has announced a new line of coaxial ratio transformers—Deca Trans, models CRT-1, CRT-2 and CRT-3. They are designed with characteristics of high input impedance, low output impedance and very low phase shift. Among the features are bold, in-line readout on concentric dials, rugged gear driven switch assembly, 0.001 percent terminal linearity, small size for minimum panel requirements,

and 6 place continuous resolution. **Circle 50 on Reader Service Card.**

Tantalum Capacitor solid electrolyte

SPRAGUE ELECTRIC CO., 35 Marshall St., North Adams, Mass., announces the new type 160D solid-electrolyte Tantalex capacitors for

hearing aid applications. Illustrated is a 4 μf, 4 v d-c unit measuring 0.080 in. in diameter by 0.0250 in. long. No leaks are possible since there is no liquid within the capacitors. **Circle 51 on Reader Service Card.**

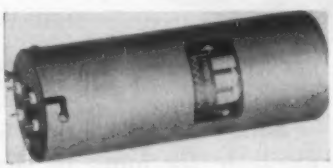


Power Relay fast operation

KURMAN ELECTRIC CO., 191 Newel St., Brooklyn 22, N. Y., announces the series 261 heavy-duty power relay. Spdt contacts are rated at carrying continuous loads of 20 amperes. Coils are available up to 15,000 ohms a-c or d-c. The relay has been tested and approved for direct use with high-powered cadmium sulphide photocells, handling high current lamp loads. Other applications include small motor control, appliances, industrial control and transmitters. Relays can be supplied for 125 C and/or 400 cps requirements. **Circle 52 on Reader Service Card.**

Crystal Oven weighs 6 oz

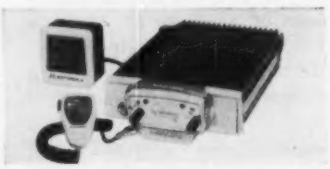
MANSON LABORATORIES, INC., 207 Greenwich Ave., Stamford, Conn. The new model RD-134 crystal oven employs a precision mercury thermoswitch, in the form of a miniature thermometer, to provide a constant drift-free reference for



very close oven control. Oven temperature is maintained to within ±0.01 C at fixed ambient, and to within ±0.1 C over an ambient range of 0 deg C to 50 C. The new oven conforms to MIL vibration and shock specifications and is usable under conditions of high acceleration. Overall dimensions are 1⅛ in. diameter by 4⅞ in. long. **Circle 53 on Reader Service Card.**

Mobile Radiophone transistorized

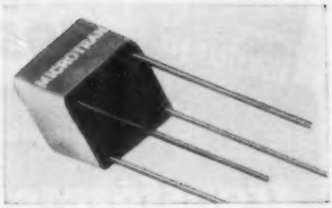
MOTOROLA, INC., 4501 W. Augusta Blvd., Chicago 51, Ill. The Motrac radiophone has a completely transistorized receiver and power supply and a partially transistorized transmitter. Printed circuitry, modules and die cast construction are used throughout the unit to further its reliability, compactness and ruggedness. The unit draws but 1.82 amperes, one third that of regular two-way radios while on standby. It is available for operation in both the low (25-54 mc) and the vhf (147-174 mc) bands. The receiver



has an audio output of 5 w. **Circle 54 on Reader Service Card.**

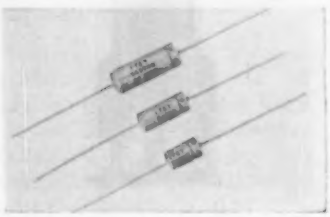
Transformers epoxy molded

MICROTRAN CO., INC., 145 E. Mineola Ave., Valley Stream, N. Y., has available a line of Veri-Miniature size transformers in epoxy molded, plug-in construction. Thirteen transformers in the line consist of inputs, outputs, interstage and chokes. They are built to MIL-T-27A class R and S, grade 2 or 4. Frequency response is ± 2 db, 200 to 10,000 cps. Reliable life is 10,000 hours minimum. **Circle 55 on Reader Service Card.**



Sealed Capacitor for 150 C operation

P. R. MALLORY & CO., INC., Indianapolis, Ind. The M2 line of hermetically sealed tantalum capacitors measure only 0.50 in. in length by 0.287 in. body diameter and 0.484 flange diameter. They are especially suitable for rugged, high-temperature service such as aircraft and missile electronic systems. They are available in a wide range of capacities from 11 μf 90 v to 140 μf 6 v at 85 C and from 11 μf 75 v to 140 μf 4 v at 150 C. **Circle 56 on Reader Service Card.**



Tantalum Capacitor rugged, reliable

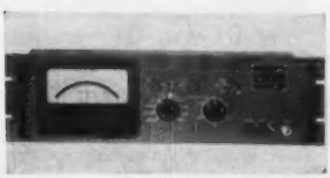
ITT COMPONENTS DIVISION, Clifton, N. J., has introduced a miniature solid electrolyte tantalum capacitor which is rugged and reliable, and highly stable in capacitance, dissipation factor and leakage current over a range from −80 C to +85 C. Well suited for use in minified electronic equipment, it comes in three case sizes which cover ratings of 2 μf at 35 working v to 240 μf at 4 working v. **Circle 57 on Reader Service Card.**

PNP Transistors medium power

GENERAL ELECTRIC CO., Syracuse, N. Y., has a new line of 30-v, ½ ampere *pnp* germanium transistors for use in industrial and data processing equipment. They are designed for medium power amplifier and low frequency, high current switching applications. Jetec designations are 2N524, 2N525, 2N526 and 2N527. The 4,000-hr life test data for typical units show that beta varies less than 10 percent and I_{co} changes less than 20 percent at a 100 C storage temperature. This makes for longer circuit life and more economical circuit design. **Circle 58 on Reader Service Card.**

E-I-R Meter rack-mounted

BELLEVILLE-HEXEM CORP., 638 University Ave., Los Gatos, Calif.



The model 110 battery powered E-I-R meter measures d-c voltage, current and resistance. Voltages of 100 mv to 1,000 v may be measured in 9 ranges. Input resistance is 111 megohms. Eighteen current ranges provide measurement of full scale values from 1 millimicroampere to 300 ma; voltage drop for all ranges is 100 mv. Direct-reading resistance scales indicate resistances from 10 ohms to 100 megohms. **Circle 59 on Reader Service Card.**

D-C Motor high efficiency

EUGENE R. KUN, 550 Fifth Ave., New York 36, N. Y. The Dunker GK26 d-c motor is designed especially for portable phonographs, tape recorders, chart recorders and similar instruments. It is up to 75 percent efficient because of the absence of iron in the armature. It is said to generate much less magnetic and electrical interference

NEW 1959

miniature

transformer catalog

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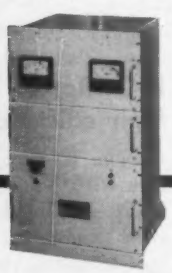

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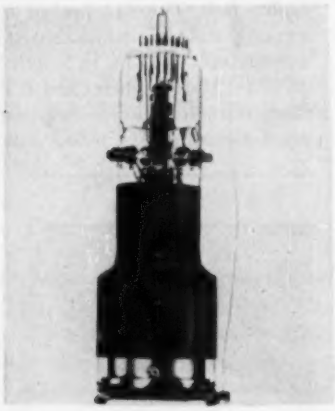
than conventional motors. The break-away torque and the weight of the armature are so small that the motor can be run on the output of photocells or thermocouples. **Circle 60 on Reader Service Card.**

Power Supply variable frequency

AERONAUTICAL ELECTRONICS SALES CO., 3101 Pico Blvd., Santa Monica, Calif. Model AE-400 variable frequency power supply is designed as a power source for testing equipment requiring power with a frequency between 300 and 1,000 cps. It is rated 300 w output continuous duty at 115 v. A 25 v output provides power for instrument testing. A unique feedback circuit holds the output voltage essentially constant from no load to full load. **Circle 61 on Reader Service Card.**

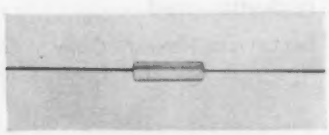
Shaft Positioner fast stepping output

G. M. GIANNINI & CO., INC., 918 E. Green St., Pasadena 1, Calif. Model 8915 Rotostepper provides controlled c-w or ccw shaft rotations in accurately positioned 2 deg increments when a pulse of d-c voltage is applied across the terminals. Stepping output is as rapid as 60 steps per sec, unlimited in either direction and torque is provided as high as 14 oz-in. Input power requirement is one ampere at 28 v, which can be applied for as short a time as 10 millisec per step of output. A precision pot may be incorporated within the housing for a divided voltage output proportional to shaft position. **Circle 62 on Reader Service Card.**



Electronic Tube with a memory

WESTINGHOUSE ELECTRIC CORP., Elmira, N. Y., has developed a storage tube, WL-7228, for use in radars. Over 100,000 pieces of information may be stored in the tube. In a fraction of a second, information received by radar can be committed to the memory of this storage tube for long periods. When needed, the information can be displayed visibly on a fluorescent screen long enough for the human observer to grasp. **Circle 63 on Reader Service Card.**



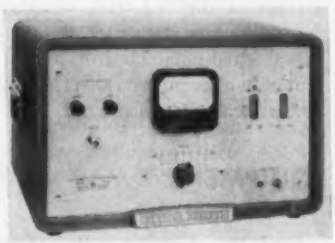
Capacitors metallized Mylar

FILM CAPACITORS, INC., 3400 Park Ave., New York 56, N. Y. New

self-healing metallized Mylar capacitors feature operating temperatures up to 125 C without derating. Standard units are rated up to 600 v d-c in any capacitance desired, with insulation resistance of 100,000 megohms per microfarad. Typical size for a 4 μf/400 v d-c capacitor in a hermetically sealed metal shell is 1⅛ in. o.d. by 2¼ in. long. **Circle 64 on Reader Service Card.**

Riverboat Radar with new antenna

Raytheon Mfg. Co., Waltham 54, Mass. New X-band radar for inland waterways navigation has a 12-ft wide slotted waveguide array antenna and narrow beamwidths to sharpen target definition. Horizontal beamwidth is 0.65 deg. Vertical beam pattern is 15 deg. Back lobes, which often produce false targets from hills and buildings, are eliminated. Range scales are one-half to eight miles. Pulse length of 0.14 μsec is used on the shorter ranges, enabling the antenna to receive returns from objects as close as 30 ft. **Circle 65 on Reader Service Card.**

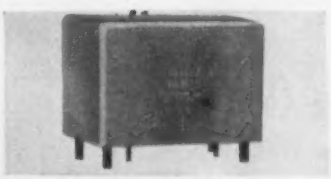


Power Meter measures 10 mw-10 w

Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif., has available a new calorimetric power meter which measures power from 10 mw to 10 w, full scale, and any frequency from d-c to 10 kmc. Model 434A is a compact, self-contained instrument which requires no barretters, thermistors, external power terminations or external plumbing. Unit is priced at $1,115. **Circle 66 on Reader Service Card.**

Bent Waveguides smooth interior

Uniwave, Inc., Farmingdale, L. I., N. Y., has come up with a new forming process for bending and twisting waveguides which produces a slick, uniformly smooth interior. The process, called "Micro-Smooth", eliminates the energy absorbing hot-spots common to waveguides formed by older processes, the company says. Draw marks, creases, burrs and ripples are all eliminated. "Micro-Smooth" allows closer tolerances to be held on inner dimensions while bends in any plane can be combined with twists and sharp radii. **Circle 67 on Reader Service Card.**



Crystal Filters three designs

Bliley Electric Co., Union Station Bldg., Erie, Pa., has announced filter networks built to individual equipment specifications over the range 2 mc to 20 mc (bandwidths from 100 cps to 100 kc). They are available in three standard designs—5 mc, 10.7 mc and 13 mc. **Circle 68 on Reader Service Card.**

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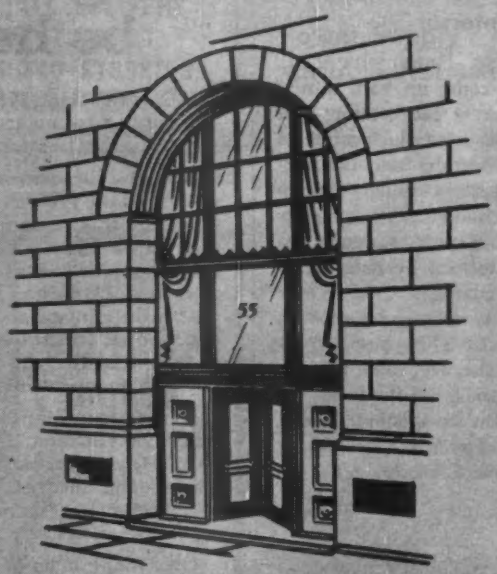

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Literature of

MATERIALS

Knitted Mesh. Metal Textile Corp., Roselle, N. J. A recent brochure describes knitted metal mesh and its unusual properties, and outlines briefly how and where it can be used to advantage. **Circle 75 on Reader Service Card.**

Temperature Indicating Devices. Paper Thermometer Co., 10 Stagg Drive, Natick, Mass. A recent brochure contains a description, list of uses and prices of Thermopaper and Thermotube paper thermometers. **Circle 76 on Reader Service Card.**

COMPONENTS

PNP Transistors. Workman TV Inc., 309 Queen Anne Road, Teaneck, N. J., has available a cross referenced interchangeability guide and price list for *pnp* transistors. It is designated No. CS 41. **Circle 77 on Reader Service Card.**

Vibration Mountings. Lord Mfg. Co., 1635 W. 12th St., Erie, Pa. Bulletin No. 710 contains complete engineering data, including tables and transmissibility curves, on design and performance of three types of Temproof mountings. **Circle 78 on Reader Service Card.**

R-F Coils. Essex Electronics, 550 Springfield Ave., Berkeley Heights, N. J. Features and specifications of the X-L coil, designed for automated or hand insertion into printed circuit boards, are presented in a recent data sheet. **Circle 79 on Reader Service Card.**

EQUIPMENT

Products Catalog. Radiation, Inc., P. O. Box 37, Melbourne, Fla. Short form catalog 1-58 covers a line of telemetering equipment, recording systems, test equipment and data processing equipment. **Circle 80 on Reader Service Card.**

Bulk Eraser. Radio Corp. of America, Camden, N. J. A new

the Week

bulk eraser, which automatically erases magnetic signals from new and recorded tape or film is fully described in a 4-page folder, Form 3R3338. **Circle 81 on Reader Service Card.**

TV Broadcast Repeaters. Adler Electronics, Inc., One LeFevre Lane, New Rochelle, N. Y., has available copies of a report on tv broadcast repeaters. The paper discusses the use of translators for relaying tv signals to communities which are out of the range of existing stations and too small to finance their own station. **Circle 82 on Reader Service Card.**

Instruments Catalog. Kay Electric Co., Maple Ave., Pine Brook, N. J., has available the 1958-59 catalog of precision electronic instruments, test equipment, and related accessories. It lists 75 instruments on 52 pages, all cross-indexed alphabetically and by instrument function. **Circle 83 on Reader Service Card.**

FACILITIES

Flight Simulator. Bendix Aviation Corp., 5630 Arbor Vitae St., Los Angeles 45, Calif., has published a booklet illustrating and describing its three dimensional flight simulator system. Applications are discussed. **Circle 84 on Reader Service Card.**

Transformers. Electro Engineering Works, 401 Preda St., San Leandro, Calif., has available a brochure describing its facilities for the design and manufacture of custom transformers for the electronics industry for industrial, military, aviation, missiles and broadcast applications. **Circle 85 on Reader Service Card.**

Technical Projects. Aero Service Corp., 210 E. Courtland St., Philadelphia 20, Pa. How geodesy, geophysics, special earth models and analogs might aid advanced technical studies and projects is told in a 16-page facilities brochure prepared for the armed services and industry. **Circle 86 on Reader Service Card.**

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BROADCASTING

Tv Rating System Starts Work

Completion of tests and checks clears the way for steady operation of tv's instant survey project

NINE-MONTH SHAKEDOWN of electronic system for compiling tv audience ratings proved successful last month with the issuing of first reports to subscribers.

Installations started at the beginning of this year (ELECTRONICS, p 48, Jan. 10) were made in New York, planned for six additional cities. American Research Bureau, operator of the system, reports that present operations cover Chicago, Detroit, Cleveland, Philadelphia, Baltimore and Washington, in addition to New York. Installations are slated for Los Angeles in about two months.

More than 500 home receivers now participate in the surveys, with an additional 1,500 expected to be in operation next year. Researchers involved in the project tell ELECTRONICS that the number of sets sampled will not greatly exceed present target figures. They say a point of diminishing returns is reached where validity of information is not increased, while cost continues to rise. Home owners who allow their sets to be used get free 90-day service for their receivers plus periodic gifts.

The system operates through leased telephone lines which link a small transponder inside the chassis of each tv set with central offices in the viewer's city. The transponder receives an interrogation pulse every 90 seconds and automatically sends a reply telling whether or not the set is on and what channel it is set for.

Equipment in the central office where interrogator pulses are originated contains an analyzer, counter and printer. Received information pulses are sorted by the analyzer, tallied by the counter and routed to print-out equipment which records received information at 90-second intervals on a continuous roll of paper.

Printing equipment is keyed to record date and time at each print-out interval. It also activates a continuous display board in the New York offices. Board shows viewers-per-channel in light patterns that vary in accordance with the information received.

A remote metering loop links the seven cities to the New York offices. Incoming information is synchronized to prevent information coming from one city to jam inputs in process from another location throughout the country.

Subscribers to the service include all three networks, 44 advertising agencies, several independent tv stations, and some sales agencies.

Pilot equipment for a rapid rating system is now undergoing review by A. C. Nielsen's market researchers. To date not much information on this system has been released, but company spokesmen say the operation "will be based on principles now known in rating survey techniques."

FCC ACTIONS

• **Amends** Land Transportation radio rules to clarify permissible scope of operations under which a private radio licensee may render service to other persons. Ruling becomes effective Oct. 15.

• **Revises** form to be used by applicants for Citizens Radio license to request additional information regarding manner in which the radio station will be used in connection with applicant's business and personal activities.

• **Invites** comments to proposed rulemaking which would make 2,566 kc and 2,031.5 wc available for maritime use for ship-to-shore transmission in the Coos Bay area of Oregon, and delete 2,566 kc and 2,009 kc in the vicinity of Astoria-Portland, Ore.

• **Finalizes** rulemaking which changes uhf noncommercial tv reservation in Pittsburgh, Pa., from channel 22 to channel 16, effective Oct. 10.

• **Changes** FCC statement of organization to transfer licensing and regulatory functions pertaining to international broadcast stations under Commission control from offices of Chief Engineer and General Counsel to Broadcast Bureau.

• **Advises** that Aviation Rules are now changed to make the 1,435-1,535-mc band available for aeronautical telemetering service.

STATION MOVES and PLANS

WIAN, Indianapolis, (educational) receives license covering increase in erp to 890 w, decrease in antenna height to 45 ft., installation of new antenna.

WTJS-FM, Jackson, Tenn., is granted change of remote control authority.

WAGY, Forest City, N. D., plans installation of new type transmitter.

WIBG, Philadelphia, is granted modification of c-p to change type transmitter.

KPOL, Los Angeles, receives permission to install new antenna,

change antenna height to 550 ft.

KOED-TV, Tulsa, Okla., is granted extension of completion date to March 21, 1959.

WJWL, Georgetown, Del., applies for c-p to increase power from 1 kw to 5 kw, install new transmitter.

WITY, Danville, Ill., files for c-p to make changes in daytime directional antenna pattern.

WKRZ, Oil City, Pa., seeks permission to increase daytime power from 250 w to 1 kw, install new transmitter.

KHVH, Honolulu, Hawaii, files application for permission to operate transmitter by remote control.

WJJD, Chicago, files for renewal of broadcast license.

WQXT-FM, Palm Beach, Fla., receives license covering changes in transmitter and increase in erp to 22 kw.

WBOW, Terre Haute, Ind., plans installation of old main transmitter as auxiliary at present site, operated by remote control.

KRXL, Roseburg, Ore., files for c-p to change frequency from 1,240 kc to 1,250 kc, change operations from unlimited to daytime, increase power from 250 w to 5 kw, install new transmitter.

KBYE, Oklahoma City, Okla., seeks permission for voluntary transfer of control from G. G. Griswold, K. B. Sweeney to B. L. Lynch.

KPIP, Riverside, Calif., files application for extension of completion date.

WRRR, Rockford, Ill., applies for voluntary assignment of license from Rock River Broadcasting Co. to Radio Rockford, Inc.

WJLB, Detroit, files for c-p to increase daytime power from 250 w to 1 kw, and install new transmitter.

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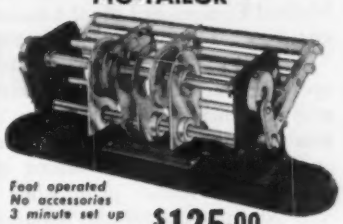

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CIRCLE 17 READERS SERVICE CARD

FOREIGN BUSINESS

UK Tests New Reactor Gear

Dounreay Atomic Power Station is slated to try out transistorized safety equipment shown in Geneva

LONDON—A new transistorized system of reactor safety equipment is slated to undergo trials at Dounreay Atomic Power Station. The system, developed by Mullard Equipment Ltd. of London, was shown for the first time at the Geneva atoms-for-peace conference.

Transistor logic circuits perform all the switching operations in place of conventional electromechanical relays. Mullard claims that the system will increase reliability and reduce power requirements.

The system initiates warning or shut-down conditions in the reactor plant when "fault" signals are received from instruments monitoring the significant parameters of the pile. To prevent a spurious shut-down, the system also determines when a fault signal is due to the failure of a monitoring channel and not to a reactor abnormality.

The monitoring channels may be of two types: "action" channels, set to trip when the parameter they measure reaches its maximum permissible excursion, requiring the reactor to be shut down, and "warning" channels, indicating abnormal parameter values not necessarily requiring a shut-down, or giving an early indication that shut-down conditions may develop.

During normal operation the monitoring channels feed a steady signal into a safety system which ceases when an abnormality occurs.

To ensure complete safeguarding, the "action" channels are grouped in threes, each group providing three independent measurements of the same parameter. The safety system accepts the inputs from each group on a two-from-three basis. The logic units are so combined that a shut-down is initiated only if fault signals are received from at least two of the channels in a particular group.

The system will also accept single inputs. These may be from the warning channels associated with each group of action channels, or from channels of either kind used independently.

Besides automatically operating the shut-down amplifiers and other emergency equipment, the system also informs the operating and maintenance staff of the condition of all parameters under surveillance. This is done by means of steady and flashing signal lamps mounted on the equipment, indicating normal or abnormal operation.

A typical system provides for a total of 80 channel inputs: 20 groups of three action channels, plus 20 other warning channels associated with the "action" groups.

DEVELOPMENTS ABROAD

• **In Saudi Arabia** the Arabian American Oil Co. is conducting a hydrographic survey of the Ras-Tanura exit channel in the Persian Gulf. Technicians aboard a tug determine water depths using echo-sounding gear. Vessel follows radio "lanes" established by master and two "slave" stations on shore as both water depth and tug location are recorded electronically. British firms Kelvin & Hughes and Decca Navigator are responsible for the operation. Study may aid improvement of channel facilities to accommodate tankers of 200,000 dead weight tons.

• **Soviet** coal mine was recently equipped with a seismic unit that reportedly gives advance warning of gas discharges. Pickup head placed in a borehole in the coal face is said to register the slightest shock. Waves are then amplified and tape recorded. If recorded shock waves exceed a certain level, men working at the face are warned to leave. Warning precedes gas discharge by 7 to 20 hours, say the Russians, permitting advance measures for removing the gases.

• **In Japan** Kyoto University announces a 350,000-v electron microscope with transmission power of 0.5 millimicron. New device reportedly prevents heat from altering molecular structure and is said to show the chemical structure of organic materials such as polyethylene. Machine was built by Shimazu Manufacturing Co.

• **In Madrid** an international automation conference organized by the Instituto de Electricidad y Automatica will be held Oct. 13-18. Subjects will include switching theory, computer research, component and design techniques for computers, and plant applications.

EXPORTS and IMPORTS

In Australia it's learned that the Corning Glass Co. will establish a tv tube plant in Victoria. Annual output of tv sets in Australia is reportedly above 300,000 units and is expected to rise further. Most sets are replicas of U. S. units manufactured either by subsidiaries of U. S. firms or under license. Large quantities of components, materials and gear are being imported from the U. S. Observers see this trend increasing as Australia, which introduced tv less than two years ago, projects tv expansion.

In London it was learned that Grundig Co. engineers in West Germany and Britain have been working on a home tape recorder for tv sound and picture aimed at the mass market. No prototype exists yet, says a company official. Grundig says it will market such a machine within two years at a

retail price estimated between $240 and $300.

Brazil's television growth is drawing Sylvania Electric's subsidiary, Productos Eletricos de Mica Ltd., into picture tube production next year. Brazil now has seven tv stations and will soon have 15. RCA is also understood to be planning picture tube production at its Belo Horizonte Plant.

British firm Elliott-Automation Ltd. of London will manufacture and market a number of Consolidated Electrodynamics Corp's analytical and control instruments under a new licensing agreement. Instruments include analytical and process-control mass spectrometers, chromatographs, moisture monitors, refractometers and oxygen analyzers. Marketing agreement covers all of British Commonwealth except Canada, permits the British firm to supply CEC's wholly owned subsidiary in Frankfurt-Main, West Germany.

Polish Academy of Sciences in Warsaw is using a Short analog computer which was shown at the recent Poznan Trade Fair. Polish scientists reportedly asked the British firm for an opportunity to study it in detail after the Fair. Firm says Poland has two Russian analog computers, one large and one of desk size, but both of "limited usefulness."

British Post Office and the Swedish Telecommunications Board have placed a $3.5 million order with Standard Telephones and Cables Ltd., an associated company of International Telephone and Telegraph Corp., for cable, repeaters and terminal equipment for a submarine cable link. Cable will provide 60 two-way telephone circuits over one single-core cable spanning the 530 nautical miles between Middlesborough, England, and Gothenburg, Sweden.

South Africa is getting the first overseas installation of the Burroughs Corp's $250,000 electronic computing system, the 205. It goes to the South African National Life Assurance Co. in Capetown.

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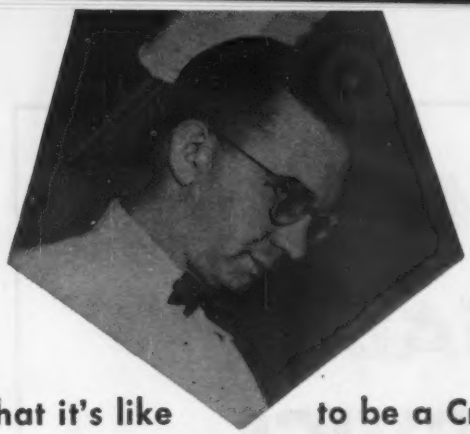

INERTIAL GUIDANCE ENGINEER John V. Prikazsky tells why airborne computer development at IBM Owego, N. Y., offers him the creative engineering career he always wanted.

What it's like to be a Creative Engineer at IBM

"Inertial guidance," explains John Prikazsky, "means aerial navigation without recourse to external reference. As an inertial guidance engineer with IBM, I have the opportunity to work on completely integrated bombing-radar-navigational systems. My work is broad — from lab studies to the analytics involved in system design—everything from shooting the North Star to heat transfer problems. That's why I like it — plus the chance I have to take on as much responsibility as I can handle."

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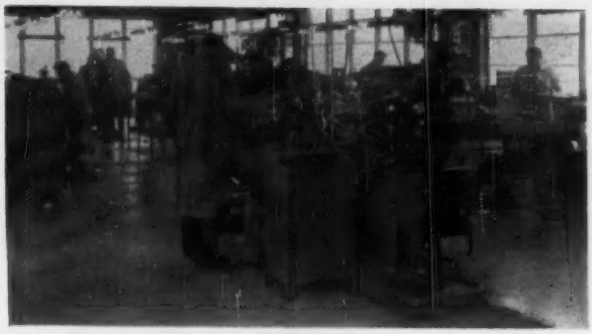

P-C Production Streamlined

A CHICAGO AREA maker of printed circuits has designed special equipment that makes the firm practically immune to production stoppages. If one occurs, only one-sixth of capacity shuts down.

Methode Manufacturing Corp., also has its six-unit, 150-ft-long etching facilities set to operate economically in small increments of total capacity.

The firm has built etching units, automatic burnishing equipment integrated with a spraying line and trolley type conveyors for curing solder masks. It is now building an automatic tester for open and short circuits. Integrated high impact spray neutralizing and stripping machines have also been built.

Company president William J. McGinley says the firm tries to avoid "the static concept" in board use and design by continuous availability of toolroom and graphic arts personnel and equipment (picture), and permitting minor changes in a matter of hours, major revisions in a few days.

McGinley says this permits original basic board layouts to be brought up-to-date without cost of complete new tooling.

To cut manual handling costs, screen operators lay freshly screened panels up to 18 in. wide by 72 in. long on a flat belt conveyor. It feeds automatically through curing and into one of three etching lines.

Parts proceed without additional handling through a three minute etch cycle, a high pressure spray rinse and into a chemical stripping machine. The chemically cleaned parts are then magazine-loaded into an automatic finishing line which burnishes a readily solderable matte finish, moves boards into a protective lacquer spray booth and conveys them through a 50 ft. infrared drying oven.

Another operational stage employs a power press line for high speed perforating and blanking on large circuit production runs.

While production dies employed may cost $500 to $15,000, cost savings on finished boards made by such tools usually permit die amortization on runs of 2,000 to 5,000 pieces. Up to 750 holes have been punched in a single stroke.

Appoint Olson Chief Engineer

RECENTLY named chief engineer of Computer Measurements Corp., North Hollywood, Calif., is John B. Olson.

Prior to joining CMC, Olson was manager of engineering services for

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Plant Briefs

Titeflex, Inc., Springfield, Mass., recently opened a new plant in Santa Monica, Calif., to be known as Titeflex-Pacific Division.

Establishment of an Astrionics lab for research and development of systems and techniques to aid in man's conquest of space is announced by **ITT Corp.** New lab will be located at the Fort Wayne, Ind., branch of the company's Missile Systems Laboratory.

Peschel Electronics, Inc., high voltage test equipment manufacturer, has moved its office and plant from New Rochelle, N. Y., to a newly acquired 204-acre site in Towners, N. Y.

News of Reps

Mitchell Spears Co. will represent Donner Scientific Co., Concord, Calif., manufacturer of analog computing equipment and precision servo accelerometers. Territory will include Texas, Louisiana, Oklahoma, Arkansas and southern Kansas.

Frank Tye Sales Co. is now exclusive sales rep in the Chicago area for Transistor Electronics Corp., Minneapolis, Minn.

Triad Transformer Corp., Venice, Calif., has added to its list of sales reps. Company will be represented in: upper New York State by **Berliant Associates;** Metropolitan New York by **Blair-Steinberg Co.;** western Pennsylvania and West Virginia by **Gene S. Root & Co.**

G. W. Moler will handle the electromechanical line of Tel-Instrument Electronics Corp., Carlstadt, N. J. Territory to be covered consists of the states of Delaware and Maryland, Washington, D. C. and northern Virginia including the counties of Arlington, Fairfax, Prince William, Albemarle, Madison, Culpepper, Fauquier, Stafford and Orange.

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True, not a single antenna remained standing. Every last one was eaten to the last savory shoot by the bamboo-loving dragons.

*However, not a single dragon survived his meal. Every last savory bamboo shoot had been poisoned by the Emperor, who obviously didn't put all his trust in electronics . . . as who would in 1405 B.B. (Before Bomac)?**

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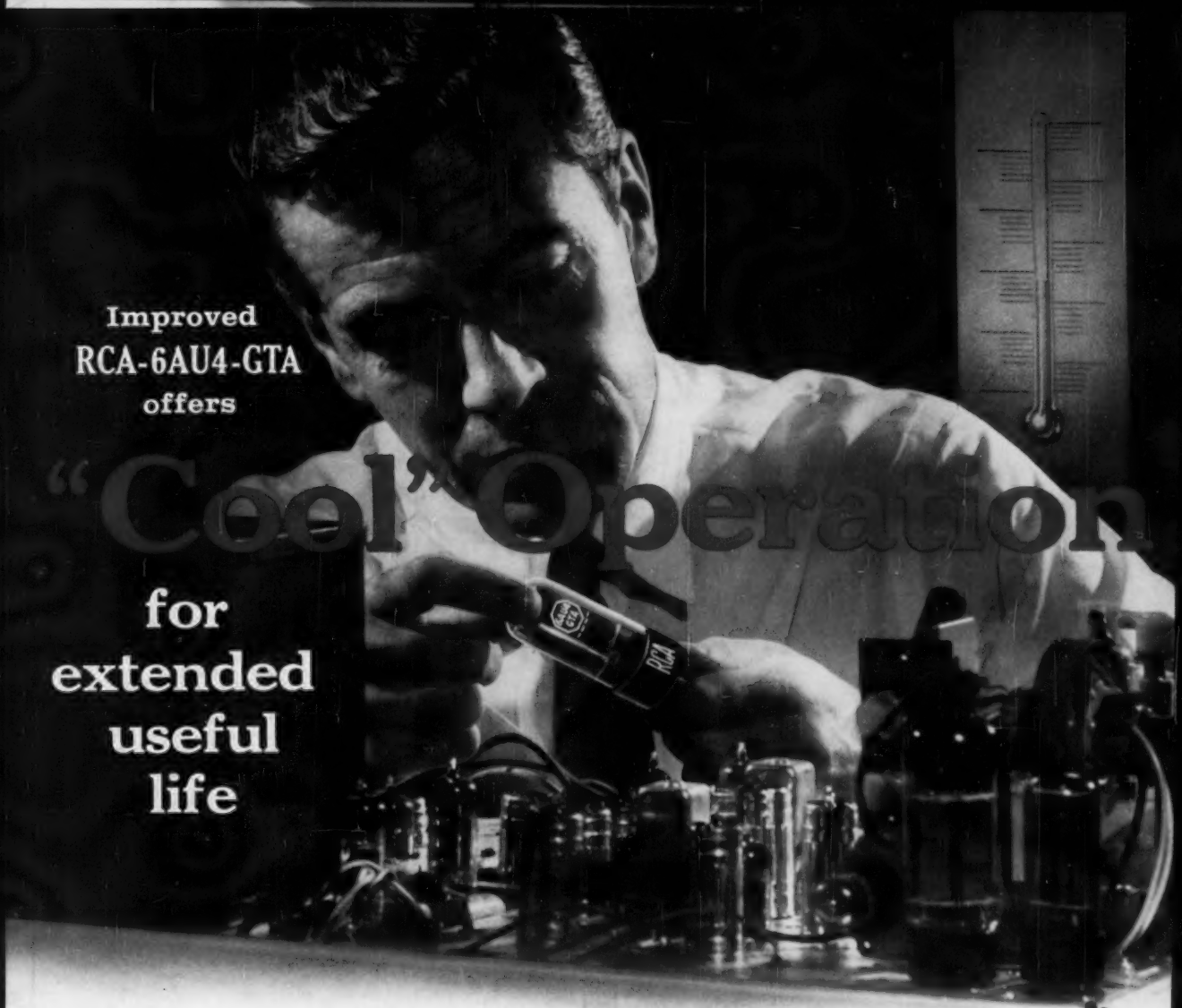

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